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A Compendium of Navy and Marine Corps Decision Support Systems for Military Personnel Planning and Operations

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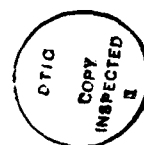
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A Compendium of Navy and Marine Corps
Decision Support Systems for
Military Personnel Planning and Operations

Lee Norton

Reviewed and released by
Joe Silverman
Director, Manpower Systems Department



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<p>This report describes decision support systems developed during the period 1966 to 1989 by the Manpower Systems Department at the Navy Personnel Research and Development Center in San Diego. The descriptions encompass various models, techniques, data bases, or systems used by Navy and Marine Corps manpower and personnel planners in managing its human resources. For each decision support system listed, there is a brief description of the operational problem, the nature of the R&D product, its use and by whom, and references to published documents describing the work. The descriptions are arranged in eight categories, according to the use of the end product. These categories consist of (1) manpower management, (2) enlisted force management, (3) officer force management, (4) civilian personnel systems, (5) recruiting and manpower supply, (6) personnel distribution and assignment, (7) costing, compensation, and budget management, and (8) information delivery systems.</p>					
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CONTENTS

	Page
INTRODUCTION	1
MANPOWER MANAGEMENT.	3
SHIP II Simulation Model	5
Pacific Fleet Logistics Input/Output Model	6
Technology-Based Aircraft Resources Model (T-BAR).	7
Base Operating Support (BOS) Models.	8
Manpower Projection Model (MAPRO).	9
Defense Planning and Programming Category (DPPC) Models.	10
Manpower Assessment System (MAS) and Manpower Requirements Allocation Data Display (MRADD).	11
ENLISTED FORCE MANAGEMENT.	13
Advancement Planning Model (ADPLAN).	15
Advancement, Strength, and Training Plans System (ADSTAP).	16
Strength Planning Model (SPAN)	17
Enlisted Personnel Projection Model (FAST/FAIM).	18
Interactive Enlisted Personnel Planning Model (MINIFAST)	19
Survival Tracking File (STF)	20
Enlisted Cohort Model (ECO).	21
Structured Accession Planning System for Enlisted Personnel (STRAP-E).	22
Advancement Interface System (ADIN II)	23
Marine Corps Enlisted Planning System (EPS).	24
Manpower Management Training Simulator (IMAGE)	25
Active Strength Predictor Model (ASP).	26
OFFICER FORCE MANAGEMENT	27
Warrant Officer/Limited Duty Officer Attrition Data Base (WOLDO)	29
Accession Into Designators (AIDS) Model.	30
Officer Retention Forecasting Model (ORFM) and Officer Force Projection Model (OPRO).	31
Structured Accession Planning System for Officers (STRAP-O/FAIM-O)	32
Marine Corps Officer Rate Projector (MCCRP).	33
Individuals Account for Officers (IAO)	34
CIVILIAN PERSONNEL SYSTEMS	35
Shore Activity Manpower Planning System (SAMPS).	37
Equal Employment Opportunity (EEO) Models.	38
Workload and Manpower Analysis System (WAMAS).	39
Navy Laboratories Staffing Models.	40

	Page
RECRUITING AND MANPOWER SUPPLY	41
Optimal Accession Requirements (OAR) Model	43
Enlisted Personnel Supply Model (EPSUM).	44
Qualified Military Available Data Base (QMA)	45
Recruiter Allocation Goal Model (RAG).	46
PERSONNEL DISTRIBUTION AND ASSIGNMENT.	47
Analysis of Ship Decrewing During Overhaul	49
Personnel Geographic Stability (PEGS) Program.	50
Enlisted Personnel Allocation and Nomination System (EPANS).	51
Officer Distribution Projection (ODPROJ) System and Officer Manning Plan Model (OMP II).	52
PCS Moves Forecasting Models	53
4-Year NROTC Scholarship Model	54
Job Assignment Simulator (JATS).	55
Assignment-Based Readiness Model	56
NROTC Summer Cruise Assignments.	57
COSTING, COMPENSATION, AND BUDGET MANAGEMENT	59
Budget Cost Management Program--Enlisted (BUCOMP-E) and Budget Cost Management Program--Officer (BUCOMP-O).	61
Naval Personnel Pay Predictor, Enlisted (NAPPE) and Naval Personnel Pay Predictor, Officer (NAPPO)	62
Retirement Analysis Models (RAC and RAM)	63
Reallocation of Military Pay Increases (REALL)	64
Billet Cost Models (BCM)	65
Permanent Change of Station (PCS) Cost Model	66
Budget Obligation Analysis and Tracking System (BOATS)	67
INFORMATION DELIVERY SYSTEMS	69
Design of Executive-Level Information System (DELIS)	71
Enlisted Personnel Planning System (EPPS).	72
Defense Personnel Analysis System (DPAS)	73
Officer Personnel Information System (OPIS).	74
Distributable Inventory Management Information System (DIMIS).	75
GLOSSARY	77

INTRODUCTION

The decision support systems described in this report were all developed during the period 1966 to the present by the Manpower Systems Department (and its predecessors) at the Navy Personnel Research and Development Center (NPRDC) in San Diego. NPRDC is the Navy's principal activity for the development of people-related technology. This includes such areas as manpower, personnel, testing, education and training, and organizational behavior. The Manpower Systems Department develops new techniques and systems for determining manpower requirements, allocating manpower resources, developing personnel inventories, and distributing/assigning those inventories to improve military readiness and control costs.

The R&D end products included in this report encompass various models, techniques, data bases, or systems used by Navy/Marine Corps manpower and personnel planners in managing human resources. The collection of descriptions is not intended to be a comprehensive list of R&D end products; nevertheless, it does contain the most important products of this research group over the last 20 years.

For each R&D product listed, there is a brief description of the operational problem, the nature of the R&D product, its use and by whom, and references to published documents describing the work. The descriptions are arranged in eight categories, according to the use of the end product. These categories consist of (1) manpower management, (2) enlisted force management, (3) officer force management, (4) civilian personnel systems, (5) recruiting and manpower supply, (6) personnel distribution and assignment, (7) costing, compensation, and budget management, and (8) information delivery systems. Some of these categories may not be self-explanatory. For instance, the term "manpower management," in the context of this report, refers to the management of positions or jobs as resources--in contrast to the management of incumbents or personnel assets. Research in this area entails development of methods for determining manpower requirements and for allocating manpower resources to competing demands. The term "force management" (whether enlisted or officer) refers to the process of building and maintaining the personnel inventories by skill and grade (and other features) that are needed to satisfy manpower requirements. The contents of the other categories--recruiting, personnel assignment, compensation, etc.--are more obvious.

Within each category, the descriptions are roughly ordered by the date of their initial development. There is a glossary at the end of the report which lists the end products alphabetically by acronym or short title. When an item in this report is a "system," there are usually a number of separate components of the system. Some of these components have been omitted for reasons of brevity, but all important models and data bases are included.

Further information on each description can be obtained from the references listed. Publications that have "AD" numbers can be obtained by qualified users from the Defense Technical Information Center (DTIC), Cameron Station, Alexand-

ria, Virginia 22314 (Telephone: Commercial (202) 274-7633 or Autovon 284-7633). The general public may order from the National Technical Information Service, Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22161 (Telephone: Commercial (703) 487-4650 (no Autovon). Publications without "AD" numbers can be obtained (in most cases) from the Manpower Systems Department (Code 11), Navy Personnel Research and Development Center, San Diego, California 92152-6800 (Telephone: Commercial (619) 553-8032 or Autovon 553-8032).

MANPOWER MANAGEMENT

SHIP II Simulation Model

Pacific Fleet Logistics Input/Output Model

Technology-Based Aircraft Resources Model (T-BAR)

Base Operating Support (BOS) Models

Manpower Projection Model (MAPRO)

Defense Planning and Programming Category (DPPC) Models

Manpower Assessment System (MAS) and
Manpower Requirements Allocation Data Display (MRADD)

SHIP II SIMULATION MODEL

PROBLEM: The allocation of personnel is one of the most critical issues facing the Navy. Manpower planners need to know (1) how many people in what skills are needed to "fight" a ship, and (2) how human performance is affected by changes in the number or skill level of manpower and the suite of shipboard equipment. A technique was required to answer these questions.

R&D PRODUCT: In 1962, the SHIP I simulation model was developed. SHIP I is a complex computer program which, upon changes to its data base, can simulate any Navy ship with a crew of up to 400 and with up to 500 equipment items or systems. SHIP I scenarios can represent missions of up to 1 year with as many as 500 training exercises or evolutions. The model permits the manipulation of manning, equipment, tasking, and ship readiness. Since 1970, the SHIP I model underwent several major revisions. The result was a large-scale computer simulation model of a destroyer-class ship, dubbed SHIP II. This revised model was analyzed in the early 1980's and was found to be inadequate for examining manpower requirements and manning policies for Navy ships. Although SHIP II is the only model that encompasses all ship evolutions and an operational scenario, there are several logic deficiencies and omissions that must be rectified to ensure fidelity of the model. Because of cost considerations and the technical difficulties involved in developing a useful ship simulation model, further efforts were not made to modify and develop SHIP II.

USE: The purpose of SHIP II was to answer resource allocation questions without experimenting with the operational fleet. Each data input involving manning, equipment, tasks, and operational readiness can be varied to test its effect on ship functioning. The most obvious type of study examines the effects of changing the number of personnel. Different mixes of skill levels also can be evaluated to arrive at an optimum manning level or to predict their effect on the efficiency of, for example, preventive and corrective maintenance. Equipment characteristics such as mean time between failures can be modified to study the impact of hardware on personnel performance. In this manner the model can be used to investigate the effect of automation or design changes without actually having to produce and install new equipment. Changes in ship deployment status can be studied with reference to equipment maintenance efficiency or equipment failure. The external task load imposed on the crew can be varied to determine whether any specified set of ratings is over- or under-worked. However, when the model was validated, it was clear that changes in program logic were required. This, together with costly and complex data requirements, precluded the use of SHIP II.

CONSUMER: Chief of Naval Operations (OP-112)

REFERENCE: Smith, M., SHIP II Simulation Model: Validation and Evaluation, San Diego: Navy Personnel Research and Development Center, January 1982 (NPRDC TR 82-26) (AD-A110-696).

PACIFIC FLEET LOGISTICS INPUT/OUTPUT MODEL

PROBLEM: The Navy needs to know the effect that changes in the size or configuration of the fleet have on the shore establishment and its requirements for manpower. Conversely, the Navy must also know the extent to which fleet elements can be supported by particular levels of shore support. This was especially true in 1980, when there was increased deployment in the Arabian Sea/Indian Ocean area due to crises in Iran and Afghanistan. At that time, the Navy lacked adequate quantitative tools to determine the effect of fleet changes on shore manpower resources.

R&D PRODUCT: In December 1980, a Pacific Fleet Logistics Input/Output Model was developed. This computer model can test the effects of major changes in policies concerning fleet homeporting and employment schedules on logistic support workload in the Pacific Fleet. It can forecast workload at Pacific Fleet supply centers and depots, based on projected fleet homeporting and employment schedules and Pacific shore-based maintenance workload.

USE: The model was intended for use by the Naval Supply Systems Command (NAVSUP-01) to forecast Navy-wide support workload requirements for operational forces in the Pacific Fleet. It can provide insight into the regional impacts of a planned change in fleet configuration so that resources can be shifted. This helps to prevent across-the-board manpower reductions which do not consider the effects on fleet support. The results of the model were used in the Office of the Chief of Naval Operations (OP-04J and OP-412E) as a resource planning and allocation tool, and to provide Navy-wide budget analyses and justifications.

CONSUMERS: Chief of Naval Operations (OP-04J and OP-412E)
Naval Supply Systems Command (NAVSUP-01)

REFERENCES: Woon, R. P., Supply Workload Implications of Increased Deployment to the Indian Ocean, San Diego: Navy Personnel Research and Development Center, October 1981 (NPRDC TR 82-1) (AD-A106 994).

Blanco, T. A., Kissler, J. M., and Woon, R. P., Modelling Logistic Support Requirements for the Pacific Fleet, San Diego: Navy Personnel Research and Development Center, May 1980 (NPRDC TN 80-16).

Kissler, J. M., Computerized Input/Output Model (CIOM): User's Manual, San Diego: Navy Personnel Research and Development Center, May 1979 (NPRDC TN 79-7).

Sorensen, S. W., and Willis, R. E., Input-Output Analysis in Navy Manpower Planning, San Diego: Navy Personnel Research and Development Center, April 1977 (NPRDC TR 77-26) (AD-A038 764).

TECHNOLOGY-BASED AIRCRAFT RESOURCES MODEL (T-BAR)

PROBLEM: In 1980, the Navy lacked quantitative methods for determining total weapon system manpower requirements based on operating tempo and system capability. This was reflected in the difficulty that analysts had in determining manpower and training requirements for new weapon systems. This was especially true for support-maintenance manpower, both military and civilian, which was usually estimated as a percentage of operational manpower. Manpower shortages in critical skill areas and increased training costs due to shorter lead times resulted. Moreover, lack of adequate skills and training were reflected in excessive time in maintenance, high failure rates due to poor maintenance, and a transition of maintenance from the military to the civilian sector at the depot level.

R&D PRODUCT: The Technology-Based Aircraft Resources (T-BAR) model was developed in FY80 to derive aircraft maintenance man-hour and skill requirements for given levels of operation (flying hours) and performance capability for existing aircraft. T-BAR was designed to relate changes in required maintenance man-hours at all maintenance levels--organizational, intermediate, and depot--to changes in desired aircraft capability. It assessed the effects of technological variables on maintenance workload requirements for fighter/attack aircraft.

USE: At the request of the Chief of Naval Operations (OP-112), T-BAR was used to forecast the total life-cycle maintenance man-hour/skill requirements for the F-18A aircraft. It was also used by the Naval Air Systems Command (NAVAIR-413) to evaluate the manpower implications of alternative design proposals for the Navy's new trainer aircraft, the VTX.

CONSUMERS: Chief of Naval Operations (OP-112)
Naval Air Systems Command (NAVAIR 413)

REFERENCES: Smith, M., Chernowitz, G., and Ciccotti, J., Life Cycle Maintenance Manpower Requirements for the F-18A: An Application of the T-BAR Methodology, San Diego: Navy Personnel Research and Development Center, January 1982 (NPRDC TR 82-24).

Blanco, T. A., Smith, M., Chernowitz, G., and Ciccotti, J., Technology-Based Aircraft Resources Model (T-BAR), San Diego: Navy Personnel Research and Development Center, March 1980 (NPRDC SR 80-11).

Blanco, T. A., Chernowitz, G., Ciccotti, J., and Lee, A., Technology Trends and Maintenance Workload Requirements for the A-7, F-4, and F-14 Aircraft, San Diego: Navy Personnel Research and Development Center, May 1979 (NPRDC TR 79-19) (AD-A070 036).

BASE OPERATING SUPPORT (BOS) MODELS

PROBLEM: The Navy lacked analytic procedures for estimating base operating support (BOS) manpower requirements. This weakened the Navy's ability to respond to budget cuts in BOS programs, which in turn degraded the ability of naval shore facilities to support the fleet. Manpower forecasting models were needed that could estimate support manpower requirements, taking into account the relationship of the requirements to the force levels being supported.

R&D PRODUCT: Computerized models to forecast long-range support manpower requirements as a function of force levels, mix, operating tempo, and deployment patterns were developed between 1982 and 1984. These BOS models forecast aggregate-level military and civilian manpower requirements for naval stations, naval air stations, training activities and real property maintenance activities.

USE: The BOS models were used by manpower managers in the Office of the Chief of Naval Operations (OP-12 and OP-44) to test the effects of major changes in ship or aircraft forces on manpower requirements at naval stations and naval air stations, and the effects of student workload and building area on BOS training and real property maintenance activities, respectively. They were used to "size" a new base in the Persian Gulf to support a carrier battle group and to estimate changes in naval station manpower requirements in response to proposals to change the homeport of several ships during the budget process of Fiscal Years 1984 and 1985.

CONSUMER: Chief of Naval Operations (OP-12 and OP-44)

REFERENCES: Barash, M., and Hudak, P., Real Property Maintenance Activity (RPMA) Programs: Analysis of Navy Manpower Requirements, San Diego: Navy Personnel Research and Development Center, March 1984 (NPRDC TR 84-35) (AD-A140 372).

King, R., Hudak, P., and Ganeshan, J., A Model for Estimating Base Operating Support (BOS) Required to Support Navy Training Activities, San Diego: Navy Personnel Research and Development Center, July 1983 (NPRDC TR 83-26) (AD-A132 287).

Hudak, P., King, R., and Rhodes, C., A Model for Estimating Navy Manpower in Base Operating Support Programs, San Diego: Navy Personnel Research and Development Center, February 1982 (NPRDC TR 82-29) (AD-A111-538).

MANPOWER PROJECTION MODEL (MAPRO)

PROBLEM: Navy planners to generate rough-cut estimates of the manpower consequences of alternative force levels. The Navy lacked quick methods to assess the impact of alternative fleet sizes and configurations on long-range support manpower requirements. In addition, it needed a way to quickly verify the manpower authorizations programmed during the planning, programming, and budgeting system process.

R&D PRODUCT: In 1983, a Manpower Projection Model (MAPRO) was developed. MAPRO is a quick-response computer model which can estimate officer, enlisted, and civilian support manpower based on the size and configuration of the fleet. Projections are organized into aggregate budget program categories so that the model can be used during the planning, programming, and budgeting system process. When ship and aircraft inventories are input into the model, manpower projections are calculated based on the differential manpower implied by different ship types and squadrons.

USE: MAPRO is used by planners in the Office of the Chief of Naval Operations (OP-120) to estimate the long-range military and civilian manpower required to support particular numbers of ships and aircraft in the fleet.

CONSUMER: Chief of Naval Operations (OP-120)

REFERENCE: Shoecraft, M., An Aggregate Manpower Projection Model for Long Range Planning, San Diego: Navy Personnel Research and Development Center, July 1985 (NPRDC TR 85-25) (AD-A158 289).

DEFENSE PLANNING AND PROGRAMMING CATEGORY (DPPC) MODELS

PROBLEM: The Navy must determine the support manpower (both military and civilian) needed to support its operational forces two to seven years in the future. These manpower requirements must be defended to the Department of Defense and Congress by major function or Defense Planning and Programming Category (DPPC).

R&D PRODUCT: Computer-based models were developed to forecast support manpower by DPPC as a function of fleet size and platform complexity. Models to forecast support manpower authorizations and manpower requirements have also been developed. All of these models have been in use since FY83. The manpower authorization models were implemented on a micro-computer in the Office of the Chief of Naval Operations (OP-12) in 1986. The manpower requirements models were implemented in 1988.

USE: The DPPC models are used by manpower managers in the Office of the Chief of Naval Operations (OP-12) to estimate the military and civilian manpower required to support the combatant ship and squadron manpower authorizations in the Department of the Navy's Five Year Defense Plan. The models provide quick information and can answer "what if" questions involving alternative force scenarios. They have been used for Congressional reviews concerning the Navy combat vs. support manpower ratios. With the help of these models, the Navy can avoid arbitrary reductions in support programs.

CONSUMER: Chief of Naval Operations (OP-12)

REFERENCE: Shoecraft, M. R., Forecasting Support Manpower by Defense Planning and Programming Category, San Diego: Navy Personnel Research and Development Center (in preparation).

MANPOWER ASSESSMENT SYSTEM (MAS) AND MANPOWER REQUIREMENTS ALLOCATION DATA DISPLAY (MRADD)

PROBLEM: Navy manpower managers are responsible for allocating funded manpower resources ("authorizations") to competing requirements for manpower. When funds decline and force requirements stay the same or increase, then the allocation of scarce manpower resources becomes especially important. Because fleet needs get satisfied first, the support components of the Navy tend to suffer. Navy planners have indicated a need for improved analytical methods and data bases to compare authorizations to requirements during the programming phase of the Planning, Programming, and Budgeting System.

R&D PRODUCT: The Manpower Assessment System (MAS) was developed in FY87. This computerized system allows for the rapid comparison of manpower requirements and authorizations for both military and civilian manpower. Comparisons can be made by designator, community, rating, rating group, paygrade, Defense Planning and Programming Categories, resource sponsor (e.g., air warfare, surface warfare), claimant, and program element. Data can be displayed in numeric and graphic form for the current year and the Five Year Defense Program years. The Manpower Requirements Allocation Data Display (MRADD) was also developed in FY87. MRADD works in conjunction with MAS. MRADD evaluates the allocation of manpower authorizations to requirements in terms of requirements satisfied. It provides for reallocations based on the conversion of "either/or" requirements. "Either/or" requirements are those that can be filled by either military or civilian authorizations. MRADD can evaluate allocations of ships, squadrons, and shore commands for officer, enlisted, and civilian manpower for all Defense Planning and Programming Categories.

USE: MAS and MRADD are used by manpower managers in the Office of the Chief of Naval Operations (OP-12G) to investigate the balance between manpower requirements and authorizations. Imbalances identified by MAS and MRADD can be corrected and critical manpower shortages in important warfare and support programs can be avoided.

CONSUMER: Chief of Naval Operations (OP-12G)

REFERENCES: MPT Subsystem of IMPS Users Manual, Monterey, CA: Systems Exploration, 9 December 1987.

Manpower Requirements Allocation Data Display User Manual, Annandale, VA: Tidewater Consultants, Inc., December 1986.

ENLISTED FORCE MANAGEMENT

Advancement Planning Model (ADPLAN)

Advancement, Strength, and Training Plans System (ADSTAP)

Strength Planning Model (SPAN)

Enlisted Personnel Projection Model (FAST/FAIM)

Interactive Enlisted Personnel Planning Model (MINIFAST)

Survival Tracking File (STF)

Enlisted Cohort Model (ECO)

Structured Accession Planning System for Enlisted Personnel (STRAP-E)

Advancement Interface System (ADIN II)

Marine Corps Enlisted Planning System (EPS)

Manpower Management Training Simulator (IMAGE)

Active Strength Predictor Model (ASP)

ADVANCEMENT PLANNING MODEL (ADPLAN)

PROBLEM: Navy-wide petty officer advancement examinations are used to screen enlisted personnel for promotion to higher grades. Each time an examination is administered, the Advancement Planner draws up a plan to select petty officers at each paygrade of each rating who will be advanced to the next higher paygrade in order to meet petty officer requirements. Numerous problems are connected with the preparation of an advancement plan. Aside from the burden of data collection, Advancement Planners had to make thousands of manual calculations to determine vacancies and advancements required for each of six petty officer grades in about 100 ratings. These advancements had to be scheduled over six month "segments." The Advancement Planner also had to consider limitations on enlisted grade strength, budgetary constraints, the distribution of scarce petty officers among ratings, and morale. Until 1966, Advancement Planners created a plan by extremely laborious manual methods. These were very time-consuming and error-prone. A computerized system of advancement planning was clearly needed to alleviate the problems of data collection, assure swift and accurate calculations, and produce a range of alternative plans.

R&D PRODUCT: In 1966, the first Advancement Planning Model (ADPLAN) was developed. This model provided a computerized procedure for determining vacancies by rating and paygrade based on requirements and attrition. ADPLAN could calculate advancements to fill these vacancies in the current advancement segment. It could also project on board strength and advancements by rating and paygrade for future segments. In 1968, and again in 1972, the model was enhanced and began to be used for policy testing as well as computing the advancement plan.

USE: ADPLAN was first used operationally in 1966. Additional capabilities were added in 1968 and it was installed on the Bureau of Naval Personnel computer. The model was incorporated into the Advancement, Strength, and Training Plans System (ADSTAP) in 1972. Throughout this period, and after, the enlisted Advancement Planner used ADPLAN on a regular basis to produce the enlisted advancement plan. By the early 1980's, critical software interfaces between the model and other personnel planning models had fallen into disrepair. It was replaced by the Advancement Interface Model (ADIN II) in 1983.

CONSUMER: Chief of Naval Operations (OP-132F)

REFERENCES: Quisenberry, T. B., The Development of Computerized Techniques for Enlisted Advancement Planning, San Diego: Naval Personnel and Training Research Laboratory, July 1972 (SRR 73-1).

Silverman, J., New Concepts in Enlisted Personnel Planning: Introduction to the ADSTAP System, San Diego: Naval Personnel and Training Research Laboratory, May 1971 (SRR 71-28) (AD-726 691).

Conner, R. D., and May, R. V., Jr., Computerized Enlisted Advancement Planning, San Diego: Naval Personnel Research Activity, June 1966 (SRR 66-21) (AD-638 461).

Conner, R. D., and Quisenberry, T. B., Desk Calculator Procedures for Determining Enlisted Personnel Planning Factors, San Diego: Naval Personnel Research Activity, June 1966 (SRR 66-19) (AD-637 788).

ADVANCEMENT, STRENGTH, AND TRAINING PLANS SYSTEM (ADSTAP)

PROBLEM: The need for enlisted personnel is always changing, in both number and type of skill. Oscillations in the defense budget and the changing composition of manpower resources available to the military services create a difficult environment for managers to develop the personnel assets needed to meet changing requirements. This places enormous demands on the Navy's personnel managers in planning the development, maintenance, and utilization of personnel skill inventories that are compatible with manpower skill requirements. Personnel managers need advanced computer-based methods to assist in developing and controlling enlisted inventories to meet changing qualitative and quantitative manpower requirements on a timely basis.

R&D PRODUCT: The Advancement, Strength and Training Plans System (ADSTAP) was developed in 1970. It is an integrated, computer-based system to support enlisted personnel planning and policy formulation. It consists of a complex arrangement of massive data files and computer programs which operate as a system. The system consists of three essential components: a planning data base (called FAIM), an enlisted personnel projection model (called FAST), and a group of planning programs and models for strength planning (SPAN) and petty officer advancements (ADPLAN, then ADIN). These components are described separately.

USE: ADSTAP is used in the Office of the Chief of Naval Operations (OP-132). It enables personnel planners to adjust rapidly to changes in manpower requirements, to identify significant areas of skill imbalance (shortages or surpluses), and to test alternative plans and policies prior to their establishment. It provides the capability to forecast qualitative and quantitative personnel requirements for long-range planning purposes. For short- and mid-range planning, ADSTAP can help assess the effectiveness of current policies and programs. It replaced the time-consuming, hand-tabulation and desk calculator methods formerly used by managers, allowing them to concentrate on the solution of problems.

CONSUMER: Chief of Naval Operations (OP-132)

REFERENCES: Silverman, J., New Concepts in Enlisted Personnel Planning: Introduction to the ADSTAP System, San Diego: Naval Personnel and Training Research Laboratory, May 1971 (SRR 71-28) (AD-726 691).

Silverman, J., Operations Guide for the ADSTAP System: An Integrated Computerized Enlisted Personnel Planning System, San Diego: Naval Personnel and Training Research Laboratory, October 1970.

STRENGTH PLANNING MODEL (SPAN)

PROBLEM: The Navy develops several strength plans each year to guide the development of the enlisted personnel force within current or projected budget constraints. The strength and grade structure of the enlisted force is projected up to 24 months into the future. Strength plans lay out the Navy's annual goals for recruitment, promotion, separations, and other personnel flows which affect the size and shape of the force. As a practical matter, there are a large number of possible force configurations, each with its own budgetary consequences. Computerized methods of personnel planning are needed to develop these alternatives, estimate the cost of the plans, and reformulate them as necessary.

R&D PRODUCT: The Strength Planning Model (SPAN) was developed to rapidly and easily provide alternative enlisted strength plans based on budget constraints and personnel management objectives. It was designed as a major component of the ADSTAP System. SPAN can rephase recruitment and advancements month by month in order to increase readiness or decrease cost. It was first implemented in 1970, and in 1973 it was enhanced to compute the effects of "early out" policy alternatives. The need for a more powerful, interactive version of SPAN, that can run on a microprocessor, has increased in the late 1980's and has been made a high R&D priority.

USE: SPAN is used by strength planners in the Office of the Chief of Naval Operations (OP-132F). It speeds up the work performed by the planner. In the case of computing a complete strength plan with pay grade backup, it is about 10,000 times faster than the earlier manual method using rotary calculators. More important, it provides the planner with a capability that was simply non-existent previously. This is the capability to produce a large number of alternative plans in rapid succession and select one which in the judgment of responsible authority best meets the objectives of the Navy.

CONSUMER: Chief of Naval Operations (OP-132F)

REFERENCE: Silverman, J., New Concepts in Enlisted Personnel Planning: Introduction to the ADSTAP System, San Diego: Naval Personnel and Training Research Laboratory, May 1971 (NPTRL SRR 71-28) (AD-726 691).

ENLISTED PERSONNEL PROJECTION MODEL (FAST/FAIM)

PROBLEM: To meet current and outyear manpower requirements, the managers of the enlisted personnel system need to shape a force of over 500,000 members spread across nine paygrades, about 100 ratings, and varying levels of experience. Development and execution of accurate plans and effective policies require methods of forecasting personnel force behavior (e.g., losses, recruits) over time and under different internal and external conditions. Powerful computerized methods are needed to support this management process.

R&D PRODUCT: The Force Analysis Simulation Technique (FAST) is a mathematical model that projects personnel inventories and flows annually by rating, paygrade, and years of active service. It allows personnel managers to evaluate alternative personnel policies in the area of separation and accession, promotion, grade management, and career field management. The FAST Input Module (FAIM) is a large and complex data processing system which provides yearly updates to the FAST model, and several other enlisted planning models and information delivery systems (e.g., ECO, EPPS, DIMIS). It also provides a historical database of inventories and personnel flows used in policy analysis and research. FAST and FAIM are components of the Navy's Advancement, Strength, and Training Plans System (ADSTAP), which integrates enlisted strength planning, advancement planning, and skill management by rating.

USE: The FAST model, and its supporting data processing system, FAIM, have been in operational use in the Office of the Chief of Naval Operations (OP-132D) since September 1974. OP-132D is the primary user but the outputs of the model are commonly used by the enlisted strength planner (OP-132F), enlisted community managers in OP-132C, the selective reenlistment bonus managers in OP-136, as well as several offices in OP-11 and OP-12. FAST is the primary mechanism for developing rating level plans for the Program Objectives Memorandum and Five Year Defense Plan.

CONSUMER: Chief of Naval Operations (OP-11, OP-12, OP-132C, OP-132D, OP-132F, and OP-136)

REFERENCES: Operations Guide for the FAIM System, Navy Personnel Research and Development Center, Volumes 1 and 2, June 1982.

B-K Dynamics, FAIM System Documentation: Version IIb (RAND), San Diego: B-K Dynamics, October 1979.

Silverman, J., "Organizational Opportunities in the Operational Use of a Personnel Planning Model," in Bryant, D. T. and Niehaus, R. J. (eds), Manpower Planning and Organization Design, New York: Plenum, 1978, pp. 85-101.

Boller, R. L., Lehto, R., Offir, J., and Silverman, J., "Design and Use of a Force Structure Simulation Model," in Charnes, A., Cooper, W. W., and Niehaus, R. J., TIMS Studies in the Management Sciences, 8 (1978), pp. 173-191.

B-K Dynamics, FAST Input Module (FAIM): System-Level Documentation, Vols. I and II, San Diego: B-K Dynamics, September and December 1977.

INTERACTIVE ENLISTED PERSONNEL PLANNING MODEL (MINIFAST)

PROBLEM: The Navy needed a method to quickly determine the effects of actual or proposed changes in personnel policies on enlisted rating populations. Although the Navy had a model of the personnel system called Force Analysis Simulation Technique (FAST), it was too detailed and comprehensive to use for quick reaction drills. The set-up of input files was time-consuming and the turn-around time was too slow for "roughly right" kinds of questions. A quicker method was required.

R&D PRODUCT: In 1975, the first version of an interactive enlisted personnel planning model called MINIFAST was developed. Using the methodology of FAST as a guide, computational procedures were simplified to arrive at tradeoffs that would permit interactive processing. Some detail and policy-testing capability were sacrificed, but the essential features of FAST methodology were captured by MINIFAST. MINIFAST can calculate the multiyear effects of losses or gains, the availability of personnel for promotion, and levels of recruitment. It can operate at the "All Navy" or individual rating level.

USE: MINIFAST was used by enlisted rating planners in the Office of the Chief of Naval Operations (OP-132) to quickly determine the effects of actual or proposed changes in personnel policies on enlisted rating populations. It is especially valuable for use in situations where policies need rapid evaluation, sorting out those that justify more intensive analysis.

CONSUMER: Chief of Naval Operations (OP-132)

REFERENCE: Stephan, R., and Campbell, D., MINIFAST: An Interactive Enlisted Personnel Planning Model, San Diego: Navy Personnel Research and Development Center, June 1983 (NPRDC TR 83-23) (AD-A130 853).

SURVIVAL TRACKING FILE (STF)

PROBLEM: The development of Navy personnel plans requires longitudinal analysis of enlisted personnel behavior. A data base containing a chronological record of individual behavior was needed.

R&D PRODUCT: The Enlisted Survival Tracking File (STF) was initiated in 1975 by the Bureau of Naval Personnel and developed in 1977. It is the only comprehensive, machine-readable source of enlisted personnel data in longitudinal form. For each individual who was in the Navy from September 1977 and after, the data base contains records that represent the status of that individual at quarterly intervals as well as selected biographical data.

USE: The STF is used by personnel planners in the Office of the Chief of Naval Operations (OP-132F) to analyze the longitudinal behavior of individuals or groups of individuals and to forecast personnel losses. It is also a primary source of data for other data bases (e.g., TRAINTRACK) and planning models (e.g., the Enlisted Cohort Model or ECO).

CONSUMER: Chief of Naval Operations (OP-132F)

REFERENCES: Gay, K. W. and Borack, J. I., The Enlisted Survival Tracking File (STF): A Revision, San Diego: Navy Personnel Research and Development Center, September 1982 (NPRDC TN 82-27) (AD-A119-717).

Gay, K. W., and Borack, J. I., The Enlisted Survival Tracking File (STF), San Diego: Navy Personnel Research and Development Center, April 1981 (NPRDC TN 81-11).

ENLISTED COHORT MODEL (ECO)

PROBLEM: During the Navy's budgeting and programming process, personnel planners need to rapidly determine whether alternative levels of personnel strength are attainable in terms of the quantity and quality of manpower available for recruitment. In addition, they have to determine the feasibility of these strength levels based on alternative retention and promotion programs and budgetary constraints. A powerful and flexible computerized system is needed to perform this function.

R&D PRODUCT: The Enlisted Cohort Model (ECO), which was first developed in 1981, forecasts future states of the Navy's inventory of enlisted personnel based on alternative recruitment, retention, promotion scenarios and budget limits. The model projects end year personnel inventories by grade, length of service, service contract mix, and demographic group. Given a cost constraint of basic pay or given a retention level, the model can build the maximum attainable end strength or inventory. Because of its demographic dimension and service contract dimension, ECO is particularly useful in forecasting attrition and non-reenlistment losses.

USE: The intended use of ECO was as a major component of the STRAP-E system. It was used in a limited way to forecast attrition based on recruit characteristics, but then fell into disuse. In 1989, the Chief of Naval Operations (OP-132C) sponsored the "resurrection" of ECO for use in strength planning. After initial tests, ECO will be redesigned for interactive operation on a mainframe, and then on a microprocessor. The Enlisted Strength Planner (OP-132F) will use ECO to evaluate personnel and manpower issues that arise from the Navy's budgeting and programming process.

CONSUMER: Chief of Naval Operations (OP-132F)

REFERENCE: The Enlisted Cohort Model (ECO), San Diego: Navy Personnel Research and Development Center, September 1983.

STRUCTURED ACCESSION PLANNING SYSTEM FOR ENLISTED PERSONNEL (STRAP-E)

PROBLEM: In order for the Navy to have a timely, consistent, and executable manpower program, a system was required that could quickly assess the impact of proposed plans and/or programs on enlisted personnel force levels for an extended planning horizon. Understanding the interplay of the external manpower supply, the personnel inventory, and future manpower requirements is particularly important in developing the manpower program.

R&D PRODUCT: The Structured Accession Planning System--Enlisted (STRAP-E) was developed in 1980. STRAP-E is a computer-based enlisted system encompassing a family of mathematical models, data bases, and supporting software. It is designed to be used during the programming of enlisted manpower to (1) determine the number of enlistments necessary to attain appropriate levels of enlisted manpower at various points in the future, (2) estimate the quality and quantity of enlistments available to satisfy accession requirements, and (3) project enlisted personnel inventory based on a set of personnel plans and policies. The main components of STRAP-E are the Enlisted Personnel Supply Model (EPSUM), the Optimal Accession Requirements Model (OAR), and the Enlisted Cohort Model (ECO). These models are supported by a data base derived from the STF and FAIM.

USE: STRAP-E was intended to be used by manpower managers in the Office of the Chief of Naval Operations (OP-120) to respond quickly to questions that arise during the enlisted manpower programming process. It could determine the number of enlistments necessary, by quality and number, to estimate the probable retention based on alternative mixes of recruits, and project the enlisted personnel inventory. STRAP-E found its most active use in OP-135C (now OP-132F), where it was used to forecast attrition based on the demographic characteristics of recruits and inventory.

CONSUMER: Chief of Naval Operations (OP-120 and OP-135C)

REFERENCES: Structured Accession Planning System - Enlisted (STRAP-E) Users Manual, Landover, MD: Science Management Corporation, January 1984.

Structured Accession Planning System - Enlisted (STRAP-E) Operators Manual, Landover, MD: Science Management Corporation, November 1983.

Operations Guide for the STRAP System, San Diego: Navy Personnel Research and Development Center, October 1979.

ADVANCEMENT INTERFACE SYSTEM (ADIN II)

PROBLEM: Through its enlisted advancement system, the Navy regulates the distribution of its petty officer personnel among paygrades and controls the expenditure of its military personnel budget. Annually, the Congress and Department of Defense establishes specific petty officer and All-Navy strength levels. These targets represent the upper bound on end-of-fiscal-year personnel inventories and define the average strength for each grade throughout the fiscal year. While constrained by these targets in the aggregate, the Navy specifies the skill or rating objectives. Without careful planning of advancements by rating and by paygrade, by month, the attainment of strength objectives would be left to chance. In the mid-1960's an Advancement Planning Model (ADPLAN) was developed to help in computing petty officer advancements. Numerous improvements were made since that time, and the model (then known as ADIN) was integrated into the Advancement, Strength, and Training Plans System (ADSTAP) in 1972. By the early 1980's, critical software interfaces between the model and other personnel planning models had fallen into disrepair. In addition, the model did not account for certain personnel flows and failed to use the most current data available.

R&D PRODUCT: A new, improved advancement planning system, known as the Advancement Interface System (ADIN II), was developed and implemented in September 1983. ADIN II is a system of databases, a model, user interfaces, and report generators. It has access to the most current available actual and predicted inventory and personnel flow data. It incorporates a complex carrydown and apportionment algorithm used for advancement planning. The heart of the system is a series of programs that manipulate actual and projected data, as well as managerial overrides, to develop monthly forecasts of gains and losses. ADIN II uses these forecasts as a basis for developing a schedule of monthly advancements by rate over an advancement cycle.

USE: Since FY84, ADIN II has been the primary tool used by the Navy's enlisted advancement planner in the Office of the Chief of Naval Operations (OP-132F) to schedule advancements.

CONSUMER: Chief of Naval Operations (OP-132F)

REFERENCES: Jordan, R., Navy Enlisted Advancement Planning and the Advancement Interface System (ADIN), San Diego: Navy Personnel Research and Development Center, February 1987 (NPRDC TR 87-17) (AD-A178 091).

Quisenberry, T. B., The Development of Computerized Techniques for Enlisted Advancement Planning, San Diego: Naval Personnel and Training Research Laboratory, July 1972 (SRR 73-1).

Silverman, J., New Concepts in Enlisted Personnel Planning: Introduction to the ADSTAP System, San Diego: Naval Personnel and Training Research Laboratory, May 1971 (SRR 71-28) (AD-726 691).

MARINE CORPS ENLISTED PLANNING SYSTEM (EPS)

PROBLEM: The current set of forecasting models and data used to support enlisted manpower planning at Headquarters, Marine Corps suffers from three fundamental problems. First, many of the models provide forecasts of force behavior which are not at the required level of detail. Second, the lack of a solid statistical foundation behind some of the models makes the resulting plans difficult to defend. Finally, the lack of a single consistent enlisted personnel database leads to inconsistent results within and across the models. These problems and others established the requirement for a new and improved system.

R&D PRODUCT: A new Enlisted Planning System (EPS) for the Marine Corps is under development. A historical enlisted personnel data base, which was completed in FY87, will supply force management models with consistent inventories and flow rates (e.g., loss rates). The central feature of EPS is the Inventory Projection Model (IPM). A prototype IPM was completed in FY88. In its final version, the IPM will produce forecasts of Marine Corps enlisted inventories and flows by occupational field, pay grade, and year of service for up to 7 years. A Manpower Planning Model (MPM) is being designed to distribute the forecasted flows from the IPM across the 12 months of each fiscal year. The MPM will also calculate the cost of alternative manpower plans.

USE: EPS will give manpower managers at Headquarters, U. S. Marine Corps (MPP-20) an accurate and reliable system to use for enlisted personnel planning. It will forecast planning requirements for accessions, promotions, reenlistments, training, and bonuses for Marine Corps enlisted personnel. It will enable managers to quickly explore "what if" alternatives and will provide the ability to test the impact of a variety of policy scenarios on the enlisted force.

CONSUMER: Headquarters, U. S. Marine Corps (MPP-20)

REFERENCES: Boyle, J. P., and Mullins, C., Forecasting Marine Corps Enlisted Personnel Losses, San Diego: Navy Personnel Research and Development Center (in preparation).

Lee, M., Allocating Promotions to Year of Service (YOS) Cells in a Marine Corps Inventory Projection Model, San Diego: Navy Personnel Research and Development Center (in preparation).

Boyle, J. P., and Holmes, R. M., Jr., An Empirical Bayes Approach to Forecasting Marine Corps Enlisted Personnel Loss Rates, San Diego: Navy Personnel Research and Development Center, September 1988 (NPRDC TN 88-54) (AD-A200-236).

Mullins, C., An Assessment of Marine Corps Enlisted Personnel Data, San Diego: Navy Personnel Research and Development Center, May 1987 (NPRDC TR 87-26) (AD-A181 315).

USMC Enlisted Personnel Planning System Structured Analysis Report, Rockville, MD: B-K Dynamics, Inc., 1 February 1986, Vols. I and II (TR-5-753).

MANPOWER MANAGEMENT TRAINING SIMULATOR (IMAGE)

PROBLEM: Because of insufficient overlap between succeeding incumbents, many officers arrive at manpower management positions with little opportunity to learn about the job from his or her predecessor. Lacking formal training or specific manpower experience, many officers require a significant amount of time on the job before they become effective. Typically, most officers learn personnel force management on the job. Force management decisions have far-reaching readiness and financial impacts. The opportunity for managers to sharpen their decision-making skills is desirable, but practicing on the personnel system itself is unacceptable. Like a pilot using a flight simulator, manpower managers need the capability to acquire basic force management skills without fear of harming the personnel system (or their careers).

R&D PRODUCT: A training simulator for enlisted force management has been developed. Three prototypes were installed for test and evaluation: one in the Pentagon under the aegis of the Deputy Assistant Secretary of Defense (Force Management and Personnel); one in the Headquarters, U. S. Marine Corps; and one in the Office of the Deputy Chief of Naval Operations (Manpower, Personnel and Training). The simulator, known as IMAGE, will enable manpower managers to acquire an understanding of how military personnel systems behave, to grasp the essential techniques for managing these systems, and to see how these systems respond to changes in policy. Simulations encompass textual material, graphic exercises, on-line tests, and a series of "management games." Each game contains a decision scenario which typifies a particular problem in force management. The skill and knowledge obtained in the simulator can be used in managing the force of enlisted personnel. Managers obtain simulated job experience by using IMAGE to test the effects of their hypothetical decisions on the size, shape and cost of the military personnel inventory.

USE: IMAGE was installed in 1988 and is used by the Army, Navy, Air Force, Marine Corps, Coast Guard, and the Government Accounting Office to train manpower managers and analysts in personnel force management and to improve the effectiveness of their decision-making skills.

CONSUMERS: Deputy Assistant Secretary of Defense (Force Management and Personnel)
Headquarters, U. S. Marine Corps (Deputy Chief of Staff for Manpower)
Deputy Chief of Naval Operations (Manpower, Personnel, and Training) (OP-01B4)

REFERENCES: IMAGE--A Management Training Simulator, San Diego: Navy Personnel Research and Development Center, September 1988.

Silverman, J., "An 'Intelligent' System for Training Military Manpower Managers," paper presented at the XXVIIth International Meeting of the Institute of Management Sciences, Brisbane, Australia, 20-23 July 1986.

ACTIVE STRENGTH PREDICTOR MODEL (ASP)

PROBLEM: Navy strength planners must manage the force to remain within the Congressionally mandated budget and personnel ceilings. To achieve these targets, strength planners require timely information about the enlisted force during the execution of the budget and accurate estimates of year end strength under conditions of considerable uncertainty. There are currently no models which provide accurate end strength forecasts of Navy enlisted personnel. In early 1989, NPRDC was requested to design and develop a model to produce very accurate short-term forecasts that would help strength planners stay within personnel ceilings imposed by the Office of the Secretary of Defense and Congress. In particular, monthly forecasts of strength and personnel flows (e.g., losses, gains, and reenlistments) are needed to monitor the paygrade distribution of the personnel force during the fiscal year. These forecasts will alert strength planners when it appears likely that ceilings will be exceeded. Policies can then be developed to alter the makeup of the force to achieve the desired budget and personnel targets.

R&D PRODUCT: An Active Strength Predictor Model (ASP) for the Total Navy case was developed in late FY89. An expanded model will be developed to provide monthly forecasts of enlisted strength by paygrade through the end of the execution year. The model will also forecast key personnel flows (such as prior service gains, losses and reenlistments, and attrition) by month and paygrade, so strength planners can evaluate alternative policies to avoid violating personnel and budget targets.

USE: ASP will give strength planners in the Office of the Chief of Naval Operations (OP-132F) an accurate and systematic method for projecting execution year strength and personnel flows. Based on these projections, strength planners can quickly explore alternatives which help the Navy remain within personnel ceilings and budgetary constraints.

CONSUMER: Chief of Naval Operations (OP-132F)

REFERENCE: None

OFFICER FORCE MANAGEMENT

Warrant Officer/Limited Duty Officer Attrition Data Base (WOLDO)

Accession Into Designators (AIDS) Model

Officer Retention Forecasting Model (ORFM) and
Officer Force Projection Model (OPRO)

Structured Accession Planning System for Officers (STRAP-O/FAIM-O)

Marine Corps Officer Rate Projector (MCORP)

Individuals Account for Officers (IAO)

WARRANT OFFICER/LIMITED DUTY OFFICER ATTRITION DATA BASE (WOLDO)

PROBLEM: Prior to 1980, force planning in the warrant officer (WO)/limited duty officer (LDO) community was without a systematic, computerized aid for monitoring inventory and attrition. As a result, force planners were dependent on ad hoc data processing of raw personnel records and/or flat paper counts. This deficiency prohibited rapid planning, policy analysis and execution, as well as detailed examination of WO and LDO subsets.

R&D PRODUCT: In 1980, a data base called WOLDO was developed. It contained a historical data set which permitted tracking of each individual officer while he/she progressed (e.g., was promoted, changed designator and/or community, changed from temporary to permanent status, etc.) through his/her naval career. In addition, WOLDO could generate inventory and attrition displays for user-defined WO and LDO "communities" (e.g., surface warfare). In 1981, the data provided by WOLDO was incorporated into the Officer Master File.

USE: WOLDO was used by planners in the Office of the Chief of Naval Operations (OP-130) and in the Naval Military Personnel Command (NMPC-1642) for analyzing WO and LDO force behavior during the design and construction of inventory projection and other force management models, and for data support during the operation of such models.

CONSUMERS: Chief of Naval Operations (OP-130)
Naval Military Personnel Command (NMPC-1642)

REFERENCE: Butler, W. C., and Rowe, M. W., Warrant Officer/Limited Duty Officer Attrition Data Base (WOLDO): System Description and User's Guide, San Diego: Navy Personnel Research and Development Center, March 1980 (NPRDC TN 80-13).

ACCESSION INTO DESIGNATORS (AIDS) MODEL

PROBLEM: Objective techniques were needed to determine the number of officers the Navy should commission in its various specialties (communities) to meet subsequent demands for experienced officers. Such techniques needed to specify the number of officers that each commissioning source (e.g., Naval Academy, NROTC, OCS, etc.) should produce and how officers produced by these sources should be distributed among specialties.

R&D PRODUCT: A computerized model, called the Accession Into Designators (AIDS) model, was developed in FY80 as a major component of the STRAP-O System. The model determines the optimal number of officers to obtain each year (for up to 10 future years) from each commissioning source to achieve future all-Navy and community-specific requirements.

USE: The AIDS module of STRAP-O was tested by the Deputy Chief of Naval Operations (OP-130) for accession planning and policy analysis purposes, but never found active use.

CONSUMER: Deputy Chief of Naval Operations (OP-130)

REFERENCES: Bres, E. S., Burns, D., Charnes, A., and Cooper, W. W., "A Goal Programming Model for Planning Officer Accessions," Management Science, 26 (1980), pp. 773-783.

Bres, E. S., Burns, A. D., Charnes, A., and Cooper, W. W., Optimal Officer Accession Planning for the U. S. Navy, San Diego: Navy Personnel Research and Development Center, November 1979 (NPRDC TR 80-5) (AD-A078 030).

OFFICER RETENTION FORECASTING MODEL (ORFM) AND OFFICER FORCE PROJECTION MODEL (OPRO)

PROBLEM: Because of its impact on accession, promotion, and budget plans, the ability to accurately forecast officer personnel inventories and officer retention is critical for personnel force management. Accurate and consistent methods that could account for policy changes and incorporate uncertainty into long term forecasts were required.

R&D PRODUCT: The Officer Retention Forecasting Model (ORFM) consists of both econometric and time series models which provide retention forecasts for Navy officers over a 7-year period by community, paygrade (PG), and years of service (YOS). First developed in 1981, ORFM has been expanded to include additional methodologies (e.g., "wear-off" for long-range forecasting) and to include coverage of additional officer communities (e.g., jet pilot). In 1981, the Officer Force Projection Model (OPRO) was also developed. It forecasts future officer personnel inventories by community, PG, and YOS by modeling officer accession, lateral transfer, and promotion behavior while using ORFM's forecasts of losses. These models constitute the core of the Structured Accession Planning System for Officers (STRAP-O).

USE: ORFM and OPRO are used by managers in the Office of the Chief of Naval Operations (OP-130) to assess the feasibility of future manpower goals, to test the sensitivity of the force to policy changes, and to develop promotion and accession plans. ORFM provides managers with the capability to determine how the officer personnel structure responds to alternative compensation plans (e.g., changes in military pay, aviation bonuses, and the retirement system) and external economic conditions. Retention forecasts from ORFM have become the basis for officer procurement and promotion plans in the Navy. OPRO enables managers not only to match officer personnel resources with requirements but also to forecast them accurately under alternative policies.

CONSUMER: Chief of Naval Operations (OP-130)

REFERENCES: Trumble, D., and Chipman, M., Time Series Forecasting of Naval Aviation Officer Losses, San Diego: Navy Personnel Research and Development Center (in preparation).

Siegel, B., Methods for Forecasting Officer Loss Rates, San Diego: Navy Personnel Research and Development Center, August 1983 (NPRDC TR 83-30) (AD-A132 573).

Bres, E., and Rowe, M., Base Force Retention Rate (BFR): An Improved Measure of Navy Officer Retention, San Diego: Navy Personnel Research and Development Center, July 1983 (NPRDC TR 83-24) (AD-A130 628).

Chipman, M., The Navy Officer Force Projection Model (OPRO), San Diego: Navy Personnel Research and Development Center, March 1983 (NPRDC SR 83-17) (AD-A125 788).

Bres, E., and Rowe, M., Development and Analysis of Loss Rate Forecasting Techniques for the Navy's Unrestricted (URL) Officers, San Diego: Navy Personnel Research and Development Center, June 1979 (NPRDC TR 79-20) (AD-A070 160).

STRUCTURED ACCESSION PLANNING SYSTEM FOR OFFICERS (STRAP-O/FAIM-O)

PROBLEM: The Navy's officer personnel managers must balance a variable supply of officers with a changing demand. Their job is complicated by the number of different officer communities, variety of career paths, complexity of personnel flows, changes in manpower requirements, and continuing shortages of critical skills. Techniques for simultaneously considering these personnel force management issues were required.

R&D PRODUCT: The Structured Accession Planning System for Officers (STRAP-O) is an integrated set of mathematical and econometric models, data bases, and supporting software. Although different in detail, the conceptual template for this system was STRAP-E. STRAP-O was installed for operational use in the Office of the Chief of Naval Operations (OP-130) in the fall of 1981, and numerous improvements and extensions have been implemented since that time. STRAP-O has the capability to project personnel structures for the unrestricted line, restricted line, and staff corps communities, as well as for the total officer force. It can determine the feasibility of proposed manpower plans or programs and implies directions likely to achieve those plans. STRAP-O contains two primary components: (1) the Officer Force Projection Model (OPRO), which forecasts future officer inventories by community (e.g., jet pilot), paygrade, and years of service; and (2) the Officer Retention Forecasting Model (ORFM), which forecasts officer loss rates for a 7-year period. Another component of STRAP-O is the Navy Flag Officer Projection Model (FLAG) which forecasts future flag inventories. STRAP-O is supported by FAIM-O, the Officer Personnel Planning Data Development System. FAIM-O consists of a longitudinal data base and a set of computer programs designed to organize, retrieve, and report historical data. FAIM-O also supports OPIS, the Officer Personnel Information System.

USE: STRAP-O is used by the Chief of Naval Operations (OP-130) to determine the feasibility of proposed manpower plans, to construct viable accession and promotion plans, and to assess the impact of alternative policies on the personnel force. It has provided a significant improvement in response time and the quality of response to budget issues, force management issues (e.g., manning a 600-ship Navy), and the development of annual officer strength, promotion, and accession plans.

CONSUMER: Chief of Naval Operations (OP-130)

REFERENCES: Mullins, C., Development of a Navy Officer End of Active Obligated Service (EAOS) Date, San Diego: Navy Personnel Research and Development Center, March 1986 (NPRDC TR 86-11) (AD-A166 350).

Rowe, M., The Structured Accession Planning System for Officers (STRAP-O): A System for Assessing the Feasibility of Officer Manpower Plans, San Diego: Navy Personnel Research and Development Center, June 1982 (NPRDC SR 82-26) (AD-A116 830).

Rowe, M., and Silverman, J., "A System for Assessing the Feasibility of U. S. Naval Officer Manpower Plans" in Mensch, G. and Niehaus, R. J. (eds), Work, Organizations, and Technological Change, New York: Plenum, 1982, pp. 103-111.

Operations Guide to the STRAP-O System, San Diego: Navy Personnel Research and Development Center, October 1981 & March 1983.

MARINE CORPS OFFICER RATE PROJECTOR (MCORP)

PROBLEM: Marine Corps manpower managers adjust the size and grade structure of the officer corps by exercising control over promotions and accessions. Since they have less control over losses, they try to forecast losses accurately. Losses play a central role in the operation of military personnel systems. Critical personnel actions, such as promotions and accessions, are triggered by the occurrence of vacancies created by losses. A technique to forecast Marine Corps officer loss behavior over a seven year planning period was required, as well as the ability to know the effect that external factors (such as employment conditions and personnel policies) have on the retention decisions of individuals.

R&D PRODUCT: The Marine Corps Officer Rate Projector (MCORP) was designed, and installed at Marine Corps Headquarters in 1986, to forecast continuation rates for existing officer manpower planning models and to permit "what if" exercises under a variety of policy alternatives (e.g., changes in military pay, changes in civilian employment conditions). MCORP, which is updated each year with current data, can also display historical and/or projected loss and continuation rates.

USE: MCORP is used by the Officer Plans Section, Headquarters, U. S. Marine Corps (MPP-30), to forecast continuation rates not only for existing Marine Corps officer manpower planning models but also for those under development. It also enables manpower planners to analyze variables that have an impact on retention, such as compensation policies (e.g., basic pay, retention bonuses, retirement benefits), civilian employment conditions, and the socioeconomic characteristics of the force (e.g., race, education).

CONSUMER: Headquarters, U. S. Marine Corps (MPP-30)

REFERENCE: MCORP Users Manual, San Diego: Navy Personnel Research and Development Center, April 1989.

INDIVIDUALS ACCOUNT FOR OFFICERS (IAO)

PROBLEM: Naval officers serving on active duty are classified in two broad categories: those occupying operational billets, both ashore and afloat; and those not in operational billets. The latter category of officers comprises the Individuals Account for Officers (IAO). It includes officers who are patients, detainees, awaiting discharge, and in transit between billets, including leave in transit; those on temporary assignment; and those in training for an operational billet and in professional education programs. The IAO is a necessary cost of doing business: officers get sick, they must travel between duty stations, they must be trained, etc. However, the IAO may also reflect inefficiencies in the officer personnel system. When schools in a training pipeline are not scheduled so that an individual can move from one to another without delay, when orders are not promptly issued to students completing or attriting from school, or when the system does not function efficiently in other ways, the size of the IAO increases. For a particular force of officer personnel, each officer in the Individuals Account directly reduces the number available to fill operational billets. In November 1988, the Chief of Naval Operations (OP-01) requested an investigation of the IAO and recommendations for ways to reduce its size.

R&D PRODUCT: An intensive investigation of the IAO was conducted in December 1988 and January 1989, and a briefing given to the Chief of Naval Operations (OP-01) on 30 January 1989. A major finding was the relative constancy of the IAO over the last 12 years, although the training component increased and the transient portion decreased. This implied that the size of the IAO was a relative intractable problem. Nevertheless, it was recommended that a central focus was needed to monitor IAO status, and actively work to implement changes in policy and practice to control the size of the IAO. Improvements in reporting and monitoring were suggested as well as aggressive management of the training pipeline. The briefing highlighted ways to reduce the delay in the training of newly commissioned ensigns and suggested procedures to promptly reassign individuals who attrite from the warfare training pipelines.

USE: The recommendations presented on 30 January 1989 were considered by the Chief of Naval Operations (OP-01) and his division heads. A new policy was initiated on the day of the briefing in response to the recommendation to implement procedures to promptly reassign individuals who attrite from the warfare training pipelines.

CONSUMER: Chief of Naval Operations (OP-01)

REFERENCE: Buckley, R., Mosteller, J., Pinciario, S., Schurmeier, D., Silverman, J., and Su, Y-L, Analysis of the Individuals Account for Officers, San Diego: Navy Personnel Research and Development Center (in preparation).

CIVILIAN PERSONNEL SYSTEMS

Shore Activity Manpower Planning System (SAMPS)

Equal Employment Opportunity (EEO) Models

Workload and Manpower Analysis System (WAMAS)

Navy Laboratories Staffing Models

SHORE ACTIVITY MANPOWER PLANNING SYSTEM (SAMPS)

PROBLEM: In the 1970's, the Navy was faced with an increased need for more effective human resource planning within the shore establishment. At both headquarters and local activity levels, new management tools were required to help develop and evaluate plans for recruitment, reductions in force, and promotion policies to best meet current and future manpower requirements. Detailed planning at the activity level had to be consistent with the overall aggregate planning decisions.

R&D PRODUCT: In 1979, the Shore Activity Manpower Planning System (SAMPS) was developed. SAMPS is an integrated system of several computerized models. These include a recruiting requirements model, used in workforce planning, and a promotion planning model to provide estimates of the numbers of people that should be hired, furloughed, or promoted to meet given manpower requirements as closely as possible. All the models were tested at several Naval Air Rework Facilities and by laboratories under the Director of Navy Laboratories.

USE: SAMPS provides manpower planners with a systematic tool for choosing an appropriate mix of hires, furloughs or separations, and promotions for each job category annually so that future inventories will be sufficient for the expected workload. It can project long term effects of proposed manpower actions and policies as well as areas where additional workload should be expanded or reduced.

CONSUMERS: Naval Air Rework Facilities
Director of Navy Laboratories

REFERENCE: Bres, E. S., Niehaus, R. J., and Sholtz, D., Shore Activity Manpower Planning Models: Development and Application, San Diego: Navy Personnel Research and Development Center, March 1979 (NPRDC TR 79-10) (AD-A066 306).

EQUAL EMPLOYMENT OPPORTUNITY (EEO) MODELS

PROBLEM: The Navy, like many organizations, is an equal employment opportunity (EEO) employer. Because of EEO law and associated pressures and incentives, Navy civilian manpower managers find it difficult to match qualified people to jobs while simultaneously providing opportunities for minorities and women to achieve adequate representation across all jobs. The supply of appropriately qualified individuals in the labor pool must be distributed in ways that are consistent with their ethnic-sexual representation in relevant populations. Realistic manpower planning and control systems were required that would accommodate EEO requirements in a reasonable, yet comprehensive and coordinated manner.

R&D PRODUCT: In 1979, two computerized EEO models were developed. One was a master goals policy planning model which was designed for policy testing at aggregate levels. It allowed decision-makers to pursue multiple manpower goals while simultaneously accommodating other concerns, including financial/budgetary limitations. The other model was a local personnel planning model which determined individual assignments at local installations. Because the determination of the qualified and available labor force is critical to the EEO goal setting process, a computational method was developed in 1981 which estimated the labor force by race/national origin and sex and projected it into the future. A model developed in 1981, called the Federal Equal Opportunity Recruitment Program model, provided guidance in the area of recruitment that would lead to the elimination of underrepresented race/national origin and sex groups.

USE: The EEO models can assist both Navy headquarters and local activity manpower planners in choosing personnel strategies that meet operating needs while complying with EEO objectives. The models accommodate the immediate workload requirements while progress is also made towards long-range targets that are set up to achieve EEO goals. In addition, the models indicate the way an organizational structure or a recruiting program should be changed to achieve EEO goals.

CONSUMER: Office of Civilian Manpower Management

REFERENCES: Atwater, D. M., Niehaus, R. J., and Sheridan, J. A., Labor Market Analysis for Equal Employment Opportunity (EEO) Planning, San Diego: Navy Personnel Research and Development Center, November 1981 (NPRDC TR 82-13) (AD-A107 938).

Aiken, D. A., Murphy, D., Nelson, A., and Niehaus, R. J., A Planning Model for Federal Equal Opportunity Recruitment Program (FEORP) Strategy Development, Washington: Office of the Assistant Secretary of the Navy (Manpower and Reserve Affairs), August 1981 (Research Report No. 40).

Charnes, A., Cooper, W. W., Lewis, K., and Niehaus, R. J., Design and Development of Equal Employment Opportunity Human Resources Planning Models, San Diego: Navy Personnel Research and Development Center, March 1979 (NPRDC TR 79-14) (AD-A066 896).

WORKLOAD AND MANPOWER ANALYSIS SYSTEM (WAMAS)

PROBLEM: The workload at the various contracting offices of the Naval Supply Systems Command (NAVSUP) increases considerably from year to year, and also changes from office to office. A big problem is caused by inflation, which has the effect of pushing a number of procurement actions from the small purchase area to the contract area. NAVSUP managers estimate that the workload associated with a contract is approximately 30 times that required for a small purchase. The inability to quantify the factors associated with such increases in workload made it difficult to either justify increased budget and manpower, or justify policy changes which would diminish workload.

R&D PRODUCT: In 1979, a computer model was developed to forecast workload at individual NAVSUP contracting offices. Given an estimate of the inflation rate, the model could accurately forecast the workload for procurement offices. Since the inflation rate is difficult to forecast, the model could be used to play "what if?" with a range of inflation rates. In 1982, the model was modified to add a manpower forecasting capability. The final computerized model was called the Workload and Manpower Analysis System (WAMAS). WAMAS could not only project workload at individual Navy contracting offices but could also relate this workload to the manpower needed to accomplish it.

USE: WAMAS has been used by managers in the Naval Supply Systems Command (NAVSUP-01 and NAVSUP-02) to provide them with accurate information for workload and manpower planning. It has helped managers in allocating contract administration manpower resources. Information derived from the model has been used to justify a recommendation to raise the ceiling on the small purchase procurement. As a result, the ceiling was raised from \$10,000 to \$25,000, thus reducing the workload.

CONSUMER: Naval Supply Systems Command (NAVSUP-01 and NAVSUP-02)

REFERENCES: Walker, A. R., Forecasting Contracting Workload and Manpower Requirements at Navy Supply Activities, San Diego: Navy Personnel Research and Development Center, January 1983 (NPRDC TN 83-3).

Walker, A. R., Inflationary Effects on Navy Procurement Workload, San Diego: Navy Personnel Research and Development Center, December 1979 (NPRDC TN 80-4).

NAVY LABORATORIES STAFFING MODELS

PROBLEM: The various Navy research and development (R&D) centers employ a large number of highly trained personnel: scientists, engineers, and technicians. Historically, the R&D centers have had difficulty in justifying their manpower needs to higher authority. The nature of R&D is not amenable to traditional work measurement methodology such as engineered time standards, and there was a lack of acceptable methods for matching workload with staffing. Based on this need, the Director of Naval Laboratories funded the development of manpower estimating models (MEM) for direct-funded scientist, engineer, and technician staffing in the eight Space and Naval Warfare Systems Command (SPAWAR) R&D Centers.

R&D PRODUCT: A laboratory-wide MEM was developed in June 1985 and laboratory-level models for each of the eight R&D Centers in December 1986. The models estimate direct-charged scientists, engineers, and technicians by R&D product area (e.g., missiles, torpedoes, electronic warfare) based on in-house vs. contracting workload and types of work (technology base, systems development, in-service, production support). The models can be used to quickly evaluate the impact of personnel ceilings and in-house dollar expenditure limits.

USE: The models are intended for use by the Space and Naval Warfare Systems Command (SPAWAR-19) in defending and justifying budget and civilian personnel ceiling requirements for R&D activities. The models also satisfy Congressional requirements to validate all manpower requirements under the Navy Management Engineering Program.

CONSUMER: Space and Naval Warfare Systems Command (SPAWAR-19)

REFERENCES: Medearis, B., and Shoecraft, M., Models for Estimating Research and Development Manpower in Navy Laboratories, San Diego: Navy Personnel Research and Development Center, October 1988 (NPRDC TN 89-1) (AD-A199 771).

Medearis, B. D., A Model for Estimating Direct-Funded Civilian Scientist, Engineer, and Technician Staffing in the Navy Research and Development Centers, San Diego: Navy Personnel Research and Development Center, October 1986 (NPRDC TR 87-2) (AD-A173 235).

RECRUITING AND MANPOWER SUPPLY

Optimal Accession Requirements (OAR) Model

Enlisted Personnel Supply Model (EPSUM)

Qualified Military Available Data Base (QMA)

Recruiter Allocation Goal Model (RAG)

OPTIMAL ACCESSION REQUIREMENTS (OAR) MODEL

PROBLEM: Traditionally, Navy enlisted recruit planning is oriented toward attaining a particular enlisted end strength each year. This approach fails to consider other force objectives, such as future requirements for petty officers, trained strength, and careerists (persons with more than four years of service). An accession policy designed to meet total end strength year by year could lead to large surpluses or shortages in other force categories in future years. A technique was needed that would allow an enlisted planner to determine an accession plan for a five to ten year planning horizon based on all force management objectives. A variety of approaches have been tried on this problem, resulting in a Recruit Input Optimization Model (RIO) and an Accession Gaming Model (AGAM). The requirement addressed here was for a long-term recruit scheduling model that could be embedded in the STRAP-E system.

R&D PRODUCT: In 1980, the Optimal Accession Requirements (OAR) model was developed. It is a computerized accession planning model that allows a user to determine an accession plan for each year of a planning period, considering both the constraints on the recruiting process (e.g., recruit quality and boot camp capacities) and objectives concerning the size and structure of the enlisted force (e.g., total end strength, end strength by grade, number of careerists, number of trained personnel, etc.). OAR is a component of the Structured Accession Planning System--Enlisted (STRAP-E) and is directly linked with the Enlisted Cohort Model (ECO). It accounts for the effects of both long-term manpower requirements and the supply of available recruits. OAR can also be run as a "stand-alone" model using recruit supply estimates and personnel flow rates obtained from other sources.

USE: OAR was intended to be used by enlisted planners in the Office of the Chief of Naval Operations (OP-120) but never found an active user in that organization, either as a stand-alone model or as a component of STRAP-E.

CONSUMER: Chief of Naval Operations (OP-120)

REFERENCES: Whisman, A. W., Optimal Accession Requirements (OAR) Model, San Diego: Navy Personnel Research and Development Center, September 1980 (NPRDC TR 80-33) (AD-A089 095).

Whisman, A. W., Yen, Y-S., and Chipman, M. D., Accession Gaming Model (AGAM), San Diego: Navy Personnel Research and Development Center, August 1980 (NPRDC TR 80-32) (AD-A089 160).

Yen, Y-S., Recruit Input Optimization (RIO) Model: Formulation and Development, San Diego: Navy Personnel Research and Development Center, February 1980 (NPRDC TR 80-12) (AD-A080 653).

Willis, R. E., Kirkland, D. D., and Silverman, J., Prolegomena to Recruit Input Planning, San Diego: Naval Personnel and Training Research Laboratory, April 1972 (SRM 72-11).

ENLISTED PERSONNEL SUPPLY MODEL (EPSUM)

PROBLEM: In the early 1980's, it became clear that the size of the prime enlistable population (males 17-21 years old) would decline because of lower fertility rates following the post World War II baby boom. In addition, it was expected that the demand for entry-level youth would increase due to plans to enlarge the size of the military services. As a result, it was important to analyze the factors underlying the decision of individuals to enlist and to forecast nonprior service enlistments based upon those factors.

R&D PRODUCT: In 1981, the Enlisted Personnel Supply Model (EPSUM) was developed as an integral feature of the Structured Accession Planning System for Enlisted Personnel (STRAP-E). EPSUM is a computerized, econometric model that can estimate the effects of certain variables on the number of high quality (e.g., high school diploma graduate) enlistees. These variables include the number of recruiters, the recruiting goal, the unemployment rate, employment expectations, interest in joining the Navy, and the ratio of civilian to military wages. The model specifically takes into account the effect that recruiter goals and effort have on the number of enlistees in each recruiting area. EPSUM was incorporated into STRAP-E in the form of a regression equation.

USE: EPSUM was used by Navy personnel planners in the context of the STRAP-E System to forecast enlistments to the Navy under alternative scenarios. The supply estimates made by EPSUM were then compared with other estimates made by other supply models (e.g., RAND).

CONSUMER: Chief of Naval Operations (OP-120)

REFERENCE: Siegel, B. S., and Borack J., An Econometric Model of Navy Enlistment Behavior, San Diego: Navy Personnel Research and Development Center, June 1981 (NPRDC TN 81-16) (AD-A101 365).

QUALIFIED MILITARY AVAILABLE DATA BASE (QMA)

PROBLEM: The supply of young men available for potential recruitment into military service varies greatly in both quality and quantity across the United States. Consequently, the allocation of recruiting resources (and recruiting goals) to states and counties has been a difficult process. Efficient assignment of recruiters, equitable allocation of recruiting goals, and effective use of limited advertising resources require a detailed knowledge of the geographic location and size of the current and future markets for young men qualified for military service. The market is often referred to as the "qualified military available" or QMA.

R&D PRODUCT: Statistical methods have been developed to provide the Marine Corps with county-level estimates of the number of male high-school graduates, 17-21 years old, who are physically and mentally qualified for Marine Corps service. Forecasts have been developed for the period 1984-1992 at both the national and local levels, using updated and improved population estimates. Updates to the QMA data base occur annually. To further refine the potential market of recruits at the county level, indicators that measure the QMA's propensity to enlist were developed.

USE: Since FY85, the Personnel Procurement Division of Headquarters, U. S. Marine Corps, has used the QMA estimates for identifying national and/or regional trends in the market for recruits. The Marine Corps has found the data especially useful for allocating its recruiters and recruit quotas among its districts and stations. In its first year of use, Marine Corps recruiters were allocated to districts using the QMA estimates and the number of "recruiter reliefs" decreased nationwide by 29 percent.

CONSUMER: Headquarters, U. S. Marine Corps (MR)

REFERENCES: Curtis, E. W., Borack, J. I., and Wax, S. R., Estimating the Youth Population Qualified for Military Service, San Diego: Navy Personnel Research and Development Center, August 1987 (NPRDC TR 87-32) (AD-A184 375).

Curtis, E., and Wax, S., Demographic and Geographic Projections of the Young Adult Population, San Diego: Navy Personnel Research and Development Center, June 1985 (NPRDC MPL TN 85-6).

RECRUITER ALLOCATION GOAL MODEL (RAG)

PROBLEM: Like other resources, Navy recruiters are allocated among the various Navy Recruiting Districts in order to attain the Navy's recruiting goals for both numbers and quality. Because of differences in the supply of manpower in each recruiting district and the complex of variables affecting recruitment, the allocation is less than optimal. Improved methods are needed to allocate recruiters to districts in order to maximize the Navy's probability of reaching its recruiting goals.

R&D PRODUCT: Beginning in FY89, the problem of recruiter allocation will be investigated. The purpose is to develop and implement a mathematical model which the Commander, Navy Recruiting Command, can use to target recruiters. The model will be called the Recruiter Allocation Goal Model (RAG). It will take into account the demographic, economic, and "propensity" differences among recruiting districts, such as employment and wage levels, interest measures, past recruiting production numbers, and various demographic characteristics. RAG will be mounted on a personal computer and operated through an interactive, menu-driven front end.

USE: RAG will be used by the Navy Recruiting Command (Code 20) to allocate enlisted and officer recruiters to Navy Recruiting Districts.

CONSUMER: Commander, Navy Recruiting Command (Code 20)

REFERENCE: None

PERSONNEL DISTRIBUTION AND ASSIGNMENT

Analysis of Ship Decrewing During Overhaul

Personnel Geographic Stability (PEGS) Program

Enlisted Personnel Allocation and Nomination System (EPANS)

Officer Distribution Projection (ODPROJ) System
and Officer Manning Plan Model (OMP II)

PCS Moves Forecasting Models

4-Year NROTC Scholarship Model

Job Assignment Simulator (JATS)

Assignment-Based Readiness Model

NROTC Summer Cruise Assignments

ANALYSIS OF SHIP DECREWING DURING OVERHAUL

PROBLEM: The shortage of fleet personnel with critical skills has been a persistent problem. In FY80, the General Accounting Office and Congress requested the Navy to evaluate the extent to which skilled fleet personnel could be increased by modifying existing overhaul policies. One approach was to use civilians in shipyards to accomplish work that is normally done by ships' crews during overhaul (hence, "decrewing"). The crewmen released from overhaul work would be reassigned to ships at sea, thereby alleviating critical shortages. Another approach was to increase the crews' skill levels through training during overhaul. In both cases, it was necessary to free the ship's crew from all or part of the work they normally do during overhaul and assign this work to civilians at the shipyard. Analysis was needed to evaluate the costs and benefits to the Navy of decrewing ships during overhaul.

R&D PRODUCT: In 1980, a set of computer programs was developed to assess the projected effects of a Navy-wide decrewing program on the Navy's manpower force structure. The analysis addressed such issues as the alleviation of fleet skill shortages, impacts on the training system, and requirements for new sea/shore rotation patterns and policies.

USE: The results of the assessment were used in Congressional testimony in July 1980 by the Chief of Naval Operations (OP-43) to support the Navy position not to decrew. The same results were used in 1981 by the Chief of Naval Operations (OP-132) to respond negatively to the decrewing request of the Commander in Chief, U. S. Pacific Fleet.

CONSUMER: Chief of Naval Operations (OP-43 and OP-132C)

REFERENCES: Blanco, T. A., and Mumm, R. H., Impact of Alternative Navy-Wide Decrewing Scenarios on Fleet/SIMA Skill Shortages: Preliminary Results, San Diego: Navy Personnel Research and Development Center, July 1980 (NPRDC SR 80-27).

Blanco, T. A., Evaluation Plan for Assessing Costs of Decrewing Ships During Overhaul: Pilot Ship III--USS CONYNGHAM (DDG 17), San Diego: Navy Personnel Research and Development Center, July 1980 (NPRDC SR 80-22).

Blanco, T. A., Projecting the Impact of a Navy-Wide Decrewing Policy on the Navy's Manpower Force Structure: A Detailed Approach, San Diego: Naval Personnel Research and Development Center, June 1980 (NPRDC SR 80-20).

PERSONNEL GEOGRAPHIC STABILITY (PEGS) PROGRAM

PROBLEM: The Navy's distribution system is designed to rotate people from sea to shore and from one job to another. Relocating personnel from one geographic location to another is very costly. Based on this, the Chief of Naval Operations (OP-01) proposed a personnel geographic stability (PEGS) program that would give individuals a preferred assignment to a single geographic location for more than one tour of duty and promote the retention of experienced personnel. Proponents of the PEGS program were concerned that PEGS could also result in adverse effects on fleet readiness through a loss of fleet balancing flexibility or a negative impact on the retention of high quality personnel. A technique was required for determining the positive and negative effects of implementing specific variations of a personnel geographic stability program.

R&D PRODUCT: In 1982, the feasibility of establishing and maintaining a PEGS program for enlisted personnel was assessed in terms of a single rating, Boiler Technician (BT). The assessment consisted of four major steps:

1. A set of assumptions were developed to form a "homesteading strategy" based on considerations of Navy-wide manning balance, priority manning objectives, and sea-shore rotation equilibrium.
2. A baseline data set was developed by using historical data and assignment policy tradeoffs.
3. The strategy was then used to develop a mathematical model for a rating community's personnel flows. The model encompassed both PEGS program participants and nonparticipants.
4. Sensitivity analysis was performed to determine the effect on the baseline model results when particular parameters take on selected values.

USE: In July 1982, the Chief of Naval Operations (OP-01) decided not to implement a pilot personnel geographic stability program due to opposition from the Commander in Chief, U. S. Pacific Fleet. While the models that were developed were never used for their original purpose, they provided some of the technical underpinning for later developments in personnel assignment.

CONSUMER: Chief of Naval Operations (OP-01)

REFERENCE: Blanco, T. A., and Buletza, P. G., Assessing the Personnel Geographic Stability Program for Boiler Technicians, San Diego: Navy Personnel Research and Development Center, March 1982 (NPRDC TR 82-40) (AD-A113 197).

ENLISTED PERSONNEL ALLOCATION AND NOMINATION SYSTEM (EPANS)

PROBLEM: Enlisted personnel assignment in the Navy is a very complex and difficult task. Numerous eligibility rules must be followed and many conflicting assignment policies must be considered. Also, there is a large volume of assignments. Because of these factors, it is humanly impossible for detailers to calculate all possible combinations of person/job matches, much less find the optimal set of assignments from a policy standpoint. Detailers and managers need methods that will reduce their workload, help them make cost-effective assignments, and execute multiple assignment policies accurately.

R&D PRODUCT: The Enlisted Personnel Allocation and Nomination System (EPANS), a series of computer models, was developed to address this problem. It can be used by detailers to match a large number of people and jobs, and creates lists of potential assignments that satisfy eligibility and policy criteria. EPANS matches people to jobs in accordance with multiple criteria, including fleet balance, job priority, permanent change of station (or moving) cost, and individual geographic location preference, among others. EPANS was first developed for non-rated personnel (Seaman, Fireman, and Airman). Then, Administrative/Deck/Supply ratings, Engineering/Hull ratings, and Aviation ratings followed. Models for these ratings were installed for test and evaluation at the Naval Military Personnel Command (NMPC) in FY88 and FY89. In FY89 and FY90, EPANS will be evaluated for operational use in making enlisted assignments. The plans for FY90 call for the expansion of EPANS to more occupational communities and its enhancement to include permanent change of station budget constraints and en route training policy goals.

USE: EPANS is being used by detailers at the Naval Military Personnel Command and at the Navy Enlisted Personnel Management Center. Tests show that the assignments made using EPANS have been superior to assignments made manually. Based on an operational test with non-rated personnel, EPANS was more effective than "hand" detailing in terms of individual preferences met and PCS cost minimization.

CONSUMERS: Naval Military Personnel Command (NMPC-40)
Navy Enlisted Personnel Management Center, New Orleans

REFERENCES: Thompson, T. J., Evaluation of Assignment Policies Using Optimization Models, San Diego: Navy Personnel Research and Development Center, May 1988 (NPRDC TR 88-12) (AD-A195 326).

Liang, T. T., and Buclatin, B. B., "Improving the Utilization of Training Resources Through Optimal Personnel Assignment in the U. S. Navy," European Journal of Operational Research, 33, pp. 183-190, 1988.

Liang, T. T., and Thompson, T. J., "A Large-Scale Personnel Assignment Model for the Navy," Decision Sciences, 18(2), pp. 234-249, Spring 1987.

Liang, T. T., Thompson, T. J., and Zimmerman, G. L., The Enlisted Personnel Allocation and Nomination System (EPANS): Prototype for the Administrative/Deck/Supply Ratings, San Diego: Navy Personnel Research and Development Center, December 1986 (NPRDC TR 87-11) (AD-A175 697).

OFFICER DISTRIBUTION PROJECTION (ODPROJ) SYSTEM AND OFFICER MANNING PLAN MODEL (OMP II)

PROBLEM: The amount of training for Unrestricted Line (URL) warfare officers has exceeded authorized levels in terms of funded billets for many years. Furthermore, newly trained surface and submarine warfare officers receive their initial experience on board ship in numbers that also exceed authorizations. With the total number of officer billets about the same as the total number of officer personnel, personnel shortages result in some operational billets, particularly in the shore establishment. This officer personnel resource allocation problem was addressed in the mid-1970's by the development and implementation of the Officer Manning Plan (OMP), which compares total billets to personnel by designator and grade, and "fair-shares" across activities according to an activity priority code. However, the OMP has several deficiencies. It ignores officer rotation, which may result in an unexecutable plan, and officer skill categories are insufficiently detailed in relation to job requirements.

R&D PRODUCT: The Officer Distribution Projection (ODPROJ) System was developed to project changes in the distributable officer populations over a planning period up to 2 years. It does this by combining Navy officer community planning data on losses, promotions, and accessions with individual officer data from the Officer Master file. The projected inventory is divided into on-board (nonrotating) and rotating categories. Each officer in the rotating inventory is identified with a pair of job skills, based on officer designator, AQD, and subspecialty. The new Officer Manning Plan (OMP II) was developed to better support the allocation function. Beginning with the rotating officers' primary and secondary skills, OMP II uses a heuristic search procedure to fill the most critical (furthest away from manning target) billets with rotating officers possessing the more available substitutable skills.

USE: Both ODPROJ and OMP II become operational in FY89. The Officer Allocation Branch of the Naval Military Personnel Command (NMPC-454) will run the models twice a year to compute attainable manning levels by activity and activity category (composite). NMPC-4 will forward the attainable manning levels produced by the models to the Chief of Naval Operations (OP-13) to verify that they are above the CNO minimum manning levels for activity categories. OP-13 will then promulgate these levels as the approved officer manning levels. Placement officers will then be responsible for ensuring that their commands are manned at the required levels.

CONSUMER: Naval Military Personnel Command (NMPC-454)

REFERENCES: Rudnik, R. A., Officer Distribution Management System: System Documentation, (Vol. I), Officer Distribution Projection Sub-System (ODPROJ), Rockville, MD: Automation Management Consultants, Inc., March 1988.

Adams, I., Nierwinski, J. and Rudnik, R. A., Officer Distribution Management System: System Documentation, (Vol. II), Officer Manning Plan Sub-System (OMP II), Rockville, MD: Automation Management Consultants, Inc., March 1988.

Ganeshan, J., and Whisman, A., Officer Distribution Projection System: Prototype Development, San Diego, Navy Personnel Research and Development Center, July 1986 (NPRDC TR 86-25) (AD-A169 973).

PCS MOVES FORECASTING MODELS

PROBLEM: Annually, the Navy moves over 300,000 of its officers and enlisted personnel. These moves are made to: (1) bring new accessions to basic and entry-level training and later to their first duty station, (2) send personnel to required training courses, (3) rotate personnel to new assignments, and (4) relocate crew members when a ship changes homeport. The moves are collectively known as permanent change of station, or PCS, moves. The Navy spends over \$500 million on PCS moves each year. These costs are part of the Navy's \$18 billion Military Personnel Navy (MPN) budget. In the formulation of the MPN budget for future years, the number of required PCS moves must be accurately estimated to ensure that adequate funds are available during budget execution to accommodate moves needed to operate and maintain the fleet. The estimated requirements for PCS moves must be defended within the Navy and before Congress as part of the MPN budget justification process. The current manual methods are sometimes inaccurate and frequently produce estimates that are difficult to defend. Objective methods are needed to develop long term PCS move forecasts for budget development as well as for defense of the budget.

R&D PRODUCT: Models to forecast officer and enlisted operational, rotational, and training (ORT) moves have been developed. ORT moves represent about 40 percent of all PCS moves. The PCS ORT projection models forecast officer and enlisted ORT moves based on projected rotation dates.

USE: In FY88, the officer and enlisted estimates for FY89-91 ORT PCS moves were produced by the models and delivered to the Naval Military Personnel Command (NMPC-7 and NMPC-46) for use in the budget preparation and justification process.

CONSUMER: Naval Military Personnel Command (NMPC-7, NMPC-46)

REFERENCES: Holmes, R. M. Jr., and Pabiniak, C., PCS ORT Move Projection Model, San Diego: Navy Personnel Research and Development Center (in press).

Holmes, R. M., Jr., and Pinciario, S. J., "Problems in Estimating the Permanent Change of Station (PCS) Move Requirements," American Statistical Association Proceedings of Business and Economic Statistics Section, 1986, pp. 637-641.

4-YEAR NROTC SCHOLARSHIP MODEL

PROBLEM: The Naval Reserve Officer Training Corps (NROTC) is the largest single source of Regular Navy and Marine Corps officers. Graduates with an NROTC scholarship qualify for unrestricted line commissions. The 4-year scholarship is the core of the NROTC program; it pays tuition, cost of textbooks, instructional fees, and a subsistence allowance of \$100 a month. Applicants are evaluated by a selection board and, if granted a scholarship, can enroll in any university with an NROTC unit or cross town affiliation. In 1987, yearly tuition for universities with NROTC units ranged from \$1,016 to \$13,756. Because of this, the funds needed to support the 4-year scholarship program are not known until the fall school term starts, students report to their NROTC units, and tuition bills are paid. This creates budgeting problems. With greater budgetary restrictions being imposed on the NROTC program, policy makers are concerned about the affordability of scholarships where students have free choice of institutions. They are beginning to consider other placement policies, and need analytic methods to assess the tradeoffs of various selection and placement strategies.

R&D PRODUCT: A model to assess alternative combinations of 4-year NROTC scholarships was developed in 1988. The model computes the assignment possibilities for applicants to universities and finds the optimal assignments for various objectives. It measures tradeoffs for various selection and placement strategies and addresses program affordability issues.

USE: The model has been used by the Chief of Naval Education and Training (NROTC Division) to analyze a variety of policy scenarios. It can project tuition costs and school preferences fulfilled for minority and non-minority applicants. In one scenario, the model indicates that it is necessary to satisfy student preferences in order to have an adequate pool of high quality minority applicants as well as sufficient candidates for its nuclear power program. This type of information is especially useful during budget reviews.

CONSUMER: Chief of Naval Education and Training (NROTC Division)

REFERENCE: Williams, J. J., A Policy Tradeoff Model for the NROTC Scholarship Program: Rapid Prototype, San Diego: Navy Personnel Research and Development Center, September 1988.

JOB ASSIGNMENT SIMULATOR (JATS)

PROBLEM: Increasingly, the Naval Military Personnel Command (NMPC) is making enlisted assignments using a computerized method called the Enlisted Personnel Allocation and Nomination System (EPANS). By the end of FY89, EPANS will be used to make about 50 percent of the enlisted assignments for NMPC and by FY90, 90 percent. EPANS will also be used to analyze personnel assignment policies prior to their promulgation. A method is required that can be used to demonstrate EPANS to enlisted detailers and managers and to train them on the method.

R&D PRODUCT: Development of a Job Assignment Simulator (JATS) was begun in FY88. So far it contains a Policy Tradeoff Module. This module shows the interplay of eight multiple, conflicting assignment policies: controlling permanent change of station cost, filling fleet job priorities, satisfying location preferences, increasing skill utilization, matching pay grade of person and job, decreasing job vacancy/redundancy, increasing use of school resources, and distributing personnel among fleets. A scenario for a particular rating can be chosen and the policy results of assignments under that scenario are shown. If another scenario is selected, the policy results of that scenario are shown next to the results from the first scenario, and a graphical comparison is provided. Summary data for the rating selected is also shown. Future plans call for the inclusion of a Personnel Assignment Module which will demonstrate how EPANS can improve enlisted personnel assignment by optimally matching people and jobs. The user can manually assign the same people and compare results.

USE: It is expected that JATS will be used by enlisted detailers and managers at the Naval Military Personnel Command (NMPC-40) to demonstrate how EPANS can assist detailers in the assignment decision process and how it can provide insights into the effects of new assignment policies before the policies are actually instituted.

CONSUMER: Naval Military Personnel Command (NMPC-40)

REFERENCES: Kirnak, A., Silverman, J., and Thompson, T. J., JATS: Job Assignment Simulator Policy Tradeoff Module, San Diego: Navy Personnel Research and Development Center (in preparation).

Thompson, T. J., Evaluation of Assignment Policies Using Optimization Models, San Diego: Navy Personnel Research and Development Center, May 1988 (NPRDC TR 88-12) (AD-A195 326).

ASSIGNMENT-BASED READINESS MODEL

PROBLEM: Due to operational, rotational, and training needs, the Navy moves a large number of its military personnel from one duty station to another. The Navy has difficulty justifying its overall permanent change of station (PCS) budget submission to Congress, because it cannot quantify the effect of a PCS budget cut on readiness. Methods are needed to quantify the impact of alternative PCS budget levels on personnel assignment and, therefore, on manning.

R&D PRODUCT: A prototype computer model was developed in FY88 that relates the number of enlisted personnel moves to Navy personnel readiness levels. The model will be used in the Naval Military Personnel Command to justify the overall PCS budget to Congress and to quantify impacts of insufficiently funded PCS programs in terms of fleet manning imbalances, reduced readiness, and the ability to meet military personnel assignment location preferences.

USE: The Assignment-Based Readiness Model is still under development and will undergo test and evaluation when operationally ready.

CONSUMER: Naval Military Personnel Command (NMPC-46, NMPC-47)

REFERENCES: Krass, I. A., Liang, T. T., and Thompson, T. J., Quantifying the Impact of the Moving Budget on Navy Enlisted Personnel Unit Readiness, San Diego: Navy Personnel Research and Development Center (in preparation).

Krass, I. A., Liang, T. T., and Thompson, T. J., "Optimization Model to Improve Personnel Unit Readiness Planning and Execution," paper presented at the 57th Symposium of the Military Operations Research Society, Fort Leavenworth, Kansas, 6-9 June 1989.

Liang, T. T., "Personnel Assignment and Unit Readiness," in Blanco, T. A. (ed.) Proceedings of the Tri-Service Topical Review on Personnel Classification/Assignment, San Diego: Navy Personnel Research and Development Center, November 18, 1987, pp. 26-35.

NROTC SUMMER CRUISE ASSIGNMENTS

PROBLEM: The Naval Reserve Officer Training Corps (NROTC) offers young men and women education and training needed to qualify for commissions in the U. S. Navy. Part of the training offered includes a two to six week cruise during summer vacation. The current process for assigning cruises to NROTC students is labor intensive and makes suboptimal assignments in terms of travel costs and quality (underway days) of cruises. An automated method which can make suggested assignments that would minimize travel costs and take into consideration student preferences, class ranking, and the quality of cruises is required to improve the summer cruise assignment process.

R&D PRODUCT: In FY89, the development of two mathematical models to improve the summer cruise assignment problem was begun. One model will be able to minimize travel costs, maximize underway days, and treat each cruise billet and each student as an individual entity. This will allow assignments to be tailored to individuals, creating an optimal set of matches. The other model will also minimize travel costs and maximize underway days but requires the NROTC units to handle the incorporation of individual considerations.

USE: One of the prototype models, when developed and implemented, will be used by the Chief of Naval Education and Training (NROTC Division) to assign NROTC students to summer cruises. Toward the end of FY89, much more information was still required, and more extensive development needed before either of the models described above could be implemented.

CONSUMER: Chief of Naval Education and Training (NROTC Division)

REFERENCE: Whisman, A. W., and Williams, J. J., "Summer Cruise Assignments for the Navy ROTC Program," paper presented at 27th Joint National Meeting of the Canadian Operations Research Society, The Institute of Management Science, and Operations Research Society of America, Vancouver, British Columbia, 8-10 May 1989.

COSTING, COMPENSATION, AND BUDGET MANAGEMENT

Budget Cost Management Program--Enlisted (BUCOMP-E) and
Budget Cost Management Program--Officer (BUCOMP-O)

Naval Personnel Pay Predictor, Enlisted (NAPPE) and
Naval Personnel Pay Predictor, Officer (NAPPO)

Retirement Analysis Models (RAC and RAM)

Reallocation of Military Pay Increases (REALL)

Billet Cost Models (BCM)

Permanent Change of Station (PCS) Cost Model

Budget Obligation Analysis and Tracking System (BOATS)

BUDGET COST MANAGEMENT PROGRAM--ENLISTED (BUCOMP-E) AND BUDGET COST MANAGEMENT PROGRAM--OFFICER (BUCOMP-O)

PROBLEM: When Navy personnel strength plans are developed, it is necessary to estimate the cost of each plan to determine its fiscal feasibility; that is, whether the plan can be executed. A rapid computerized method for estimating enlisted and officer pay and allowances was required to support the budgeting process.

R&D PRODUCT: The Budget Cost Management Program--Enlisted (BUCOMP-E) was developed in 1970. This program employs input from the Advancement, Strength, and Training Plans System (ADSTAP) in the form of projected gains and losses, reenlistments, and projected personnel inventories. This input, together with personnel costing rates supplied by budget planners, is used to calculate projected budget costs that characterize a particular enlisted strength plan. In 1972, a similar version of BUCOMP-E was developed for officers (BUCOMP-O). Both programs have also been enhanced to include other military personnel costs, such as subsistence, permanent change of station, and travel. They not only can calculate budget costs but can also determine the effect of pay raises and changes in entitlements. BUCOMP-E and BUCOMP-O can compute budget costs hundreds of times faster than the hand calculation methods previously used, and without posting errors.

USE: Both BUCOMP-E and BUCOMP-O have been used by analysts in the Naval Military Personnel Command (NMPC-7) since the early 1970's. The programs provide convenient computerized systems for producing budget costs associated with various strength plans when the plans are still in the development stage. In 1980, the programs were cited by the Office of the Secretary of Defense--Comptroller as an example to be followed by other services.

CONSUMER: Naval Military Personnel Command (NMPC-7)

REFERENCE: Silverman, J., New Concepts in Enlisted Personnel Planning: Introduction to the ADSTAP System, San Diego: Naval Personnel and Training Research Laboratory, May 1971 (SRR 71-28) (AD-726 691).

NAVAL PERSONNEL PAY PREDICTOR, ENLISTED (NAPPE) AND NAVAL PERSONNEL PAY PREDICTOR, OFFICER (NAPPO)

PROBLEM: Recruitment, promotion, retirement, and other managerial policies are all constrained by the size of the Navy's military personnel budget (MPN). In formulating that budget, it is necessary to estimate the size and shape of the personnel inventory. A substantial portion of the MPN budget is devoted to enlisted basic pay, which is so large (in the billions) that an error of one half of one percent may result in an over-expenditure of millions. Budget forecast errors of this magnitude cause radical and disruptive changes in the personnel program, which in turn degrades readiness.

R&D PRODUCT: The Naval Personnel Pay Predictor, Enlisted (NAPPE) is a computerized, statistical (time series) model for predicting enlisted basic pay. An officer version, NAPPO, employs the same techniques. NAPPE was originally implemented in FY79 in the Office of the Chief of Naval Operations (OP-135). In FY83, an interactive version of NAPPE was installed in the Naval Military Personnel Command (NMPC-71). NAPPO was installed in FY84, also in NMPC-71.

USE: Both NAPPE and NAPPO are used by the Navy's military manpower budget department (NMPC-71) during the annual budget development process. NAPPE's one-year-ahead forecast for basic pay, tested on 15 years of data, has an average error of only 0.16 of one percent. NAPPO's one-year-ahead forecast error was only 0.37 of one percent for the past seven years.

CONSUMER: Naval Military Personnel Command (NMPC-71)

REFERENCES: Chipman, M., Forecasting the Naval Officer Personnel Force Structure to Estimate Basic Pay, San Diego: Navy Personnel Research and Development Center, November 1979 (NPRDC TR 80-4) (AD-A078 029).

Chipman, M., Forecasting the Naval Enlisted Personnel Force Structure to Estimate Basic Pay, San Diego: Navy Personnel Research and Development Center, November 1977 (NPRDC TR 78-4) (AD-A046 878).

RETIREMENT ANALYSIS MODELS (RAC AND RAM)

PROBLEM: The cost of military retirement is a large component of the defense budget. Because of cost of living increases, retirement costs tend to rise disproportionately to total defense manpower costs. In response to these rising costs, there are periodic proposals to modify the military retirement system. The Chief of Naval Operations (OP-01) needed analytical methods to evaluate the effect of proposed retirement policies on Navy personnel retention and total retirement costs.

R&D PRODUCT: In 1978, a Retirement Analysis Cost Model (RAC) was developed to determine the cost of alternative retirement policies, given certain retention assumptions. RAC computed the present value of remaining in the military, as opposed to retiring or leaving for civilian employment prior to retirement. It could also compare regular military compensation, severance, vesting, and retirement costs for alternative retirement policies. RAC could determine both the short-run and long-run effects of a retirement policy. When comparing different retirement policies, the model is capable of accounting for various assumptions, such as (1) the economic incentives of a retirement policy, (2) promotional probabilities, (3) involuntary separation probabilities, and (4) civilian earnings opportunities. Subsequently, a series of models (RAM I and II) were developed to assess the retention consequences of alternative retirement proposals, first for the total Navy (RAM I), then for major enlisted occupational groups (RAM II).

USE: RAC and RAM were used by the Chief of Naval Operations (OP-134) to evaluate the effects of proposed retirement policies. The analysis based on these models helped prevent the imposition of new retirement systems which would lead to Navy personnel shortages and force quality problems.

CONSUMER: Chief of Naval Operations (OP-134)

REFERENCES: Chipman, M. D., and Mumm, H., Forecasting Naval Enlisted Occupation Retention Behavior Under Alternative Retirement Systems, San Diego: Navy Personnel Research and Development Center, November 1979 (NPRDC TR 80-3) (AD-A078 028).

Chipman, M. D., Comparative Analysis of Enlisted Retirement Behavioral Models, San Diego: Navy Personnel Research and Development Center, November 1979 (NPRDC TN 80-1).

Chipman, M. D., and Mumm, H., Forecasting Naval Enlisted Retention Behavior Under Alternative Retirement Systems, San Diego: Navy Personnel Research and Development Center, November 1978 (NPRDC TR 79-4) (AD-A062 106).

Chipman, M., Silverman, J., and Willis, R., Techniques for Evaluating Military Retirement Policies, San Diego: Navy Personnel Research and Development Center, August 1978 (NPRDC TR 78-29) (AD-A059 291).

Chipman, M., and Silverman, J., Analysis of Alternative Military Retirement Policies: An Approach with Some Results, San Diego: Navy Personnel Research and Development Center, April 1978 (NPRDC TN 78-8).

REALLOCATION OF MILITARY PAY INCREASES (REALL)

PROBLEM: In order to provide flexibility in managing service manpower programs, there are several administrative mechanisms available for allocating military pay increases. For example, the President is authorized to redistribute up to 25 percent of the annual increase in military basic pay to either the basic allowance for quarters (BAQ), the basic allowance for subsistence (BAS), or both. Additionally, the President is permitted to reallocate up to 25 percent of a pay raise to one or more selected pay grades. Further, Congress is allowed to fund different pay raises for different pay grades, a strategy called "pay targeting." To accurately assess the impact of reallocation and targeting on the pay of individuals and on military personnel budgets, a technique was required to estimate the pay rate and cost implications of pay increase and reallocation scenarios.

R&D PRODUCT: In 1981, a computer-based model (called REALL) was developed. The model can project the long-term and immediate impact of various types of basic pay reallocation on pay rates and budgetary costs. Basic pay resulting from reallocations to BAQ and BAS can be contrasted to estimates derived from simple, across-the-board, non-reallocated pay increases. The estimated effect of reallocation on the take-home pay of typical personnel can also be examined. A similar exercise can be performed for costs, with particular emphasis on cost elements such as bonuses and retirement, which are linked to basic pay and are informally identified as "drag along" costs.

USE: The results produced by REALL were used by manpower analysts in the Office of the Chief of Naval Operations (OP-134) to evaluate pay raise plans posed by Congress, the Department of Defense and the Navy. The model provides analysts with a clear estimate of the direct costs related to pay increase and reallocation proposals, as well as the "drag along" costs.

CONSUMER: Chief of Naval Operations (OP-134)

REFERENCE: Wilcox, Walter W., The Reallocation of Military Pay Increases, San Diego: Navy Personnel Research and Development Center, June 1982 (NPRDC TR 82-49) (AD-A117 584).

BILLET COST MODELS (BCM)

PROBLEM: The cost of personnel needed to operate and maintain newly developed weapons systems is very high and adds to the total system support costs. If a large number of very skilled and experienced personnel are needed to operate and maintain a weapons system, the costs can become prohibitive. Methods (and data) were needed that would permit these manpower and training costs to be considered when a system was being designed, so that accurate forecasts of system costs could be determined and design characteristics could be selected that were economical in terms of manpower.

R&D PRODUCT: An integrated system of four Billet Cost Models (BCM's) representing all major categories of Navy manpower expenditures--officers and enlisted personnel, reserves, and Navy civil service employees--was developed, starting in 1981. Each BCM provides estimates of the annual and life cycle costs of manning authorized billets with people of specified skills (ratings) and levels of experience (pay grades) in each of the four categories. In addition to computing life-cycle manpower costs for individual weapons systems, the cost models can estimate life cycle manpower costs Navy-wide. The costs include all major personnel expenditures (over a "life cycle" of 30 years), expressed on a year-by-year basis.

USE: The BCM's are used by military and civilian contractors in costing manpower requirements. Some users have been the Naval Sea Systems Command (to determine the manpower costs of operating and maintaining the Vulcan Phalanx Air Defense System), the Naval Underwater Systems Center (to study cost trade-offs in automating selecting SSN billets), and the Naval Audit Service in San Diego (to assess enlisted versus civilian billet costs for tug and small craft operations). The BCM's are operated by the Office of the Chief of Naval Operations (OP-134) for users in programming and force structure planning, and in weapons system design procurement. They have greatly simplified forecasting aggregate Navy costs during the Planning, Programming, and Budgetary System cycle. They also provide the opportunity to lower overall life cycle costs of weapons systems by permitting manpower and training support requirements to be considered quantitatively, along with other design trade-off variables during the design phase of each weapon system.

CONSUMERS: Chief of Naval Operations (OP-134)
Naval Sea Systems Command
Naval Underwater Systems Center
Naval Audit Service, San Diego
Military and Civilian Contractors

REFERENCES: Butler, R. A., and Frankel, O. L. The Billet Cost Model System, Santa Monica, CA: The Assessment Group, July 1983 (R-207).

Frankel, O. L., and Opstad, D. G., Billet Cost Model System: Billet Cost Estimates, Santa Monica, CA: The Assessment Group, July 1983.

Frankel, O. L., and Opstad, D. G., Billet Cost Model System: Program Source Code Listings, Santa Monica, CA: The Assessment Group, July 1983 (R-212).

PERMANENT CHANGE OF STATION (PCS) COST MODEL

PROBLEM: Permanent change of station (PCS) policies and funding have been of special interest to Congress, the Office of the Secretary of Defense, and the military services for many years. In the Navy, the pricing of prospective PCS moves was done manually, a process that was time-consuming and prone to error. An automated pricing system was needed to compute PCS distance and cost.

R&D PRODUCT: A Permanent Change of Station Cost Model was developed in 1984 to improve the efficiency and accuracy of computing individual PCS cost estimates. In FY86, the Naval Military Personnel Command (NMPC) requested that the number of duty stations in the model be expanded from 506 to 1,096. Adding such a large number of duty stations required too much computer time. A new methodology using a shortest-path algorithm was developed and incorporated into the model. The revised model was completed in 1987. It provides a quick and accurate method for calculating PCS costs.

USE: The revised PCS Cost Model was delivered to the Naval Military Personnel Command (NMPC-470) to calculate mileage and cost computations for PCS moves. The tedious manual methods formerly used required an average of 5 minutes to complete the cost estimation for each PCS move. With the PCS Cost Model, the same process takes less than 5 seconds and eliminates human error. With over a quarter of a million PCS moves per year, the time savings were significant. More important, the elimination of human error increases the accuracy of the mileage calculations by over 30 percent.

CONSUMER: Naval Military Personnel Command (NMPC-470)

REFERENCES: Zimmerman, G. L., A Shortest-Path Method for Estimating Permanent Change of Station (PCS) Costs, San Diego: Navy Personnel Research and Development Center, September 1986 (NPRDC TR 86-27) (AD-A173 629).

Wong, D. C., Jerardo, A. R., and Nakada, M. K., Permanent Change of Station (PCS) Cost-Generation Model (PCSMOD), San Diego: Navy Personnel Research and Development Center, August 1984 (NPRDC TR 84-52) (AD-A144 938).

BUDGET OBLIGATION ANALYSIS AND TRACKING SYSTEM (BOATS)

PROBLEM: Each year the Navy spends about \$18 billion to compensate its active duty military personnel. These payments are made from the Military Personnel, Navy (MPN) budget, which is managed by the Naval Military Personnel Command (NMPC-7). This requires a continuing assessment of how much money the Navy owes its members, and monitoring these financial obligations with respect to planned monthly spending levels. These functions are performed separately for over 100 pay and allowance categories (called entitlements), each composed of numerous subcategories. To determine obligations each month, the Navy's budget analysts extract data from voluminous reports. Obligation estimates are made each month and then compared to planned year-to-date expenditures. The comparison reveals whether the budget is being executed according to plan, or if corrective actions are needed. The manual extractions, transcription, and manipulation of the data needed to estimate and monitor obligations is very time consuming and subject to error. A computerized system for retrieving financial data, computing current obligation estimates, and tracking estimated year-to-date obligations (vice planned expenditures) is needed.

R&D PRODUCT: The Budget Obligation Analysis and Tracking System (BOATS) was developed to satisfy this need. First developed in 1984, BOATS has subsequently been enhanced with new capabilities. A data base of military pay data from July 1981 to the present, for over 400 entitlements, has been produced. Interactive software for retrieving these data in graphic and numeric formats has also been developed. BOATS derives monthly obligation estimates for all 400 entitlements and interactively retrieves and/or overrides these estimates. The system can retrieve system-generated obligation estimates each month, evaluate these estimates with respect to current and historical financial data, and enter overrides to the system's estimates of obligations. In FY87, a budget monitoring module of BOATS was developed to compare year-to-date obligations to year-to-date planned expenditures to determine if the budget is being executed according to plan. A BOATS-like system is also being developed to manage and monitor the Reserve Personnel, Navy (RPN) budget.

USE: BOATS has replaced the manual system previously used by the Naval Military Personnel Command (NMPC-7) budget analysts and has streamlined the obligation determination and MPN budget monitoring process. The use of BOATS has enabled the Navy to avoid the over-obligation of MPN funds by an estimated \$17-25 million.

CONSUMER: Naval Military Personnel Command (NMPC-7)

REFERENCES: Pinciario, S. J., "The Budget Obligation Analysis and Tracking System (BOATS) and Its Role in Military Personnel, Navy (MPN) Budget Management," in Sheldon (ed.), Governmental Financial Management Research Issues, Washington: Balmour (in press).

Pinciario, S. J., The Development and Implementation of the Budget Obligation Analysis and Tracking System (BOATS), San Diego: Navy Personnel Research and Development Center, January 1989 (NPRDC TR 89-5) (AD-A206 089).

Pinciario, S., "Lessons Learned in Developing a Decision Support System for Managing the Navy's Military Personnel Budget," in Stohr, Hoevel, Chu, Haynes, and Speckhad (eds.), Proceedings of the Twentieth Annual Hawaii International Conference on System Sciences, Vol 1, 1987, pp. 715-724.

INFORMATION DELIVERY SYSTEMS

Design of Executive-Level Information System (DELIS)

Enlisted Personnel Planning System (EPPS)

Defense Personnel Analysis System (DPAS)

Officer Personnel Information System (OPIS)

Distributable Inventory Management Information System (DIMIS)

DESIGN OF EXECUTIVE-LEVEL INFORMATION SYSTEM (DELIS)

PROBLEM: Major policy and programming decisions in the area of enlisted manpower and personnel management are made under severe time constraints and with very limited amounts and kinds of information. A system was required that supported executive decisions with appropriate volume, form, and frequency of data.

R&D PRODUCT: The Design of an Executive-Level Information System (DELIS) began in 1977. An information delivery system was developed in 1981 which could project the military and civilian manpower implications of changes in military force levels (e.g., number of ships and aircraft) and the constraints (e.g., external supply) on satisfying those manpower requirements. In 1983, another module was developed to display manpower requirements and authorizations in terms of claimant, program element, and other groupings of manpower resources. Information was provided in colorgraphic or numeric forms, as desired. The technology pioneered in DELIS was later used in the Officer Personnel Information System (OPIS), the Enlisted Personnel Planning System (EPPS), the Distributable Inventory Management Information System (DIMIS), the Defense Personnel Analysis System (DPAS), and the Budget Obligation Analysis and Tracking System (BOATS).

USE: DELIS was tested by the Deputy Chief of Naval Operations (OP-01) and the Assistant Secretary of the Navy to support information needs of executives in the area of manpower management.

CONSUMER: Chief of Naval Operations (OP-01)

REFERENCES: Dickieson, J., and Rowe, M. W., "The Evolution of an Information Delivery System: Descendants of DELIS," in Chu, Haynes, Hoevel, Speckard, Stohr, and Sprague (eds.), Proceedings of the Nineteenth Hawaii International Conference on System Sciences, 1986, pp. 426-433.

Silverman, J., and McLandrich, J., "An Information Delivery System for Navy Manpower Executives," in Fry, J. P., Panko, R. R., Sprague, R. H., Jr., and Weissman, L. (eds), Proceedings of the Seventeenth Hawaii International Conference on System Sciences, 1984, pp. 574-583.

ENLISTED PERSONNEL PLANNING SYSTEM (EPPS)

PROBLEM: The ability of personnel planners to obtain the data needed to manage the Navy's enlisted force was limited by batch data processing, long turnaround times, and continuing requests for data extraction jobs.

R&D PRODUCT: A prototype of the Enlisted Personnel Planning System (EPPS), an information delivery system, was developed in 1979 as the first module of an Executive-Level Information System (see DELIS). The system was reinstalled operationally in 1986, and again in 1989 as part of DIMIS. It provides immediate and convenient access to a substantial amount of historical Navy enlisted personnel information which is displayed graphically or in numeric tables. The source of this data is FAIM--the data processing system which supports the FAST model.

USE: EPPS is used in the Office of the Chief of Naval Operations (OP-132D) to explore the aggregate behavior of the enlisted personnel system. It reduces the data processing burden on analysts, while increasing their data analysis capabilities. EPPS is also used to quickly satisfy routine kinds of data retrieval requirements.

CONSUMER: Chief of Naval Operations (OP-132D)

REFERENCE: A Users Guide for the Enlisted Personnel Planning System (EPPS), San Diego: Navy Personnel Research and Development Center, June 1986.

DEFENSE PERSONNEL ANALYSIS SYSTEM (DPAS)

PROBLEM: Regardless of advancements in computer technology, many management organizations are dependent on batch-oriented information systems. These systems tend to be slow and inflexible. An information delivery system was needed for the Office of the Assistant Secretary of Defense (OASD)--Force Management and Personnel (FM&P) that provided access to personnel information on demand, and in the form desired by the manager.

R&D PRODUCT: In FY84 the Defense Personnel Analysis System (DPAS) was developed. DPAS is an information delivery system (IDS) which, like other IDS, was patterned after DELIS. The user can retrieve historical inventory, promotion, loss, and gain data for each of the four military services. Functions within DPAS permit the user to display data (e.g., inventories by service, skill, grade, and time in service) or to transform the data (e.g., create a loss rate) and then display it. The DPAS database has been expanded to include gender and ethnic group dimensions. In 1985, the Objective Force subsystem was added, which accommodates desired or projected forces, and an Officer Personnel subsystem was added in 1986. In 1988, an enlisted bonus management subsystem was added to help manpower managers evaluate the service bonus submissions.

USE: DPAS is used by manpower managers in the Office of the Assistant Secretary of Defense (FM&P) to perform policy analysis on a large volume of historical and projected personnel data submitted by the individual services. It is also used to address numerous ad hoc queries. It replaced a labor intensive clerical process and magnified the analytic capability of the force managers.

CONSUMER: Office of the Assistant Secretary of Defense--Force Management and Personnel (OASD-FM&P)

REFERENCES: Dickieson, J., and Rowe, M. W., "The Evolution of an Information Delivery System: Descendants of DELIS," in Chu, Haynes, Hoevel, Speckard, Stohr, and Sprague (eds.), Proceeding of the Nineteenth Hawaii International Conference on System Sciences, 1986, pp. 426-433.

Defense Personnel Analysis System (DPAS): User's Guide, San Diego: Manpower Systems Department, Navy Personnel Research and Development Center, March 1985.

OFFICER PERSONNEL INFORMATION SYSTEM (OPIS)

PROBLEM: In order to meet current and future needs for officers, the Navy must forecast losses and devise plans for accession, promotion, and retention that will produce the desired personnel structure. To support this process, immediate and convenient access to historical counts of Navy officer personnel information was needed.

R&D PRODUCT: The Officer Personnel Information System (OPIS) was developed in FY85, building on the technology pioneered in DELIS. It is an information delivery system composed of modules that display a variety of historical inventory, personnel flow, and retention statistics in both graphical and array formats. OPIS can be used quickly and easily to satisfy routine kinds of data requirements, and also provides the ability to explore the historical behavior of Navy officer personnel. It reduces the data processing burden of analysts, while increasing their analysis capabilities. OPIS is an integral part of the Structured Accession Planning System for Officers (STRAP-O), and the source of its data is FAIM-O.

USE: OPIS is used in the Office of the Chief of Naval Operations (OP-130 and OP-136D) by manpower managers concerned with officer promotion, accession, retention, compensation, and strength planning.

CONSUMER: Chief of Naval Operations (OP-130 and 136D)

REFERENCES: Officer Personnel Information System (OPIS) User's Guide, San Diego: Manpower Management Systems Department, Navy Personnel Research and Development Center, April 1988.

Rowe, M., The Structured Accession Planning System for Officers (STRAP-O): A System for Assessing the Feasibility of Officer Manpower Plans, San Diego: Navy Personnel Research and Development Center, June 1982 (NPRDC SR 82-26) (AD-A116 830).

DISTRIBUTABLE INVENTORY MANAGEMENT INFORMATION SYSTEM (DIMIS)

PROBLEM: Several times each year, as part of the Navy's regular programming and budgeting process, the Deputy Chief of Naval Operations (OP-132) must develop enlisted accession, promotion, training, and strength plans. The information needed to develop these plans is often unavailable at the requisite level of detail and consistency. Specifically, the information needed to manage the enlisted force by distribution community, gender, and sea/shore status is not readily available. An information delivery system is needed to produce current and historical data quickly and accurately.

R&D PRODUCT: In FY87, the development of a system called the Distributable Inventory Management Information System (DIMIS) was begun. As part of DIMIS, a data base and information delivery system were completed in early 1989, and installed in OP-132 for test and evaluation. The data base consists of historical quarterly inventory and flow counts broken down by the paygrade, length of service, sea/shore, gender, and several other characteristics of enlisted ratings. The information delivery system is interactive, providing easy access to the data and presenting it in either graphic or display form.

USE: DIMIS will be used by personnel managers in all aspects of enlisted personnel planning and managing, particularly in accession and advancement planning, bonus policy development, and the management of skill communities.

CONSUMER: Deputy Chief of Naval Operations (OP-132)

REFERENCE: None

GLOSSARY

GLOSSARY

		Page
ADIN II	Advancement Interface System II	23
ADPLAN	Advancement Planning Model	15
ADSTAP	Advancement, Strength, and Training Plans System	16
AIDS	Accession Into Designators Model	30
ASP	Active Strength Predictor Model	26
ASSIGN-BASED READINESS	Assignment-Based Readiness Model	56
BCM	Billet Cost Models	65
BOATS	Budget Obligation Analysis and Tracking System	67
BOS	Base Operating Support Models	8
BUCOMP-E	Budget Cost Management Program--Enlisted	61
BUCOMP-O	Budget Cost Management Program--Officer	61
DELIS	Design of Executive-Level Information System	71
DIMIS	Distributable Inventory Management Information System	75
DPAS	Defense Personnel Analysis System	73
DPPC	Defense Planning and Programming Category Models	10
ECO	Enlisted Cohort Model	21
EEO	Equal Employment Opportunity Models	38
EPANS	Enlisted Personnel Allocation and Nomination System	51
EPPS	Enlisted Personnel Planning System	72
EPS	Marine Corps Enlisted Planning System	24
EPSUM	Enlisted Personnel Supply Model	44
FAIM	FAST Input Module	18

		Page
FAIM-O	Officer Personnel Planning Data Development System	32
FAST	Force Analysis Simulation Technique	18
IAO	Individuals Account for Officers	34
IMAGE	Manpower Management Training Simulator	25
JATS	Job Assignment Simulator	55
MAPRO	Manpower Projection Model	9
MAS	Manpower Assessment System	11
MCORP	Marine Corps Officer Rate Projector	33
MINIFAST	Interactive Enlisted Personnel Planning Model	19
MRADD	Manpower Requirements Allocation Data Display	11
NAPPE	Naval Personnel Pay Predictor, Enlisted	62
NAPPO	Naval Personnel Pay Predictor, Officer	62
NAVY LABS STAFFING	Navy Laboratories Staffing Models	40
NROTC SCHOLARSHIP	4-Year NROTC Scholarship Model	54
NROTC SUMMER CRUISE	NROTC Summer Cruise Assignments	57
OAR	Optimal Accession Requirements Model	43
ODPROJ	Officer Distribution Projection System	52
OMP II	Officer Manning Plan Model II	52
OPIS	Officer Personnel Information System	74
OPRO	Officer Force Projection Model	31
ORFM	Officer Retention Forecasting Model	31
PACFLT I/O MODEL	Pacific Fleet Logistics Input/Output Model	6
PCS COST MODEL	Permanent Change of Station Cost Model	66
PCS MOVES FORECAST	PCS Moves Forecasting Models	53

		Page
PEGS	Personnel Geographic Stability Program	50
QMA	Qualified Military Available Data Base	45
RAC	Retirement Analysis Cost Model	63
RAG	Recruiter Allocation Goal Model	46
RAM	Retirement Analysis Models	63
REALL	Reallocation of Military Pay Increases	64
SAMPS	Shore Activity Manpower Planning System	37
SHIP DECREWING	Analysis of Ship Decrewing During Overhaul	49
SHIP II	SHIP II Simulation Model	5
SPAN	Strength Planning Model	17
STF	Survival Tracking File	20
STRAP-E	Structured Accession Planning System-- Enlisted	22
STRAP-O	Structured Accession Planning System for Officers	32
T-BAR	Technology-Based Aircraft Resources Model	7
WAMAS	Workload and Manpower Analysis System	39
WOLDO	Warrant Officer/Limited Duty Officer Attrition Data Base	29